Contents

OF PART I.

Index

TO PART I, VOL. II.

INDEX TO NAMES OF CONTRIBUTORS

TO PART I, VOL. II.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. I.—1843.—Vol. II.

Prospectus of an Agricultural and Horticultural Society in India.

The advantages arising from a number of persons uniting themselves as a Society for the purpose of carrying forward any undertaking, is now so generally acknowledged, that to detail them appears almost superfluous. Not only must the experience and knowledge of an insulated individual be far less than that of a body of men, but his means for making experiments and conducting necessary operations, must be proportionably more circumscribed. A body of men engaged in the same pursuit, form a joint stock of their information and experience, and thereby put every individual in possession of the sum total acquired by them all. Even the mistakes and miscarriages of its members when recorded, prove a source of advantage to the body, while the labours of every one communicate new energy to his associates, and thus produce exertions which would never have been made, had they continued in their individual capacity instead of

uniting as a body. Men of enlarged minds have been long convinced of the great advantages to be derived from Societies of scientific men, and have occasionally recommended them; yet scarcely a Society was formed before the commencement of the last century, and not one before the year 1640. Since the commencement of the last century, however, their advantages have been more and more developed, so that there is now scarcely an object relating either to religion, to science, or to the promotion of arts and manufactures, which is not carried forward by a Society formed for the express purpose.

Among other objects, Agriculture has for some years been greatly promoted by Societies formed with that view in England and other countries. The benefits which have already arisen from them are almost incalculable, and the prospects opened by their present labours are of the most encouraging nature. The capabilities of the soil to enrich a nation to an almost indefinite extent, have been clearly demonstrated by their reports, and the present value of landed property in England compared with its former value, must convince any reasonable person, that among those objects for the promotion of which associations can be formed, there are few more important than the agriculture of a country.

The practical part of agriculture in all countries is conducted by men whose habits and circumstances, as well as their circumscribed means, dispose them to pursue the same routine of operations, whether right or wrong, to which their predecessors were accustomed. They must necessarily be, to a great degree, ignorant of the methods practised in distant provinces, and on soils differing from those on which they reside, and are therefore found to be strongly prejudiced against every innovation, whatever advantages it may promise. An Agricultural Society by collecting information relative to the actual practice in different countries, or in different provinces of the same country, could not fail of discovering

many errors in the management of land and stock, which it would endeavour to correct; while on the other hand modes of cultivation practised in particular districts would be recognized as superior and worthy of adoption elsewhere; the nature of different soils, and the advantages or disadvantages of particular crops, as well as of particular modes of management, would be better understood, the nature and value of stock and the most obvious means of improving it, be gradually developed, and, in short, innumerable improvements in every department would thereby be gradually introduced.

An Agricultural Society in India, therefore, which it is the object of this Prospectus to recommend, could not fail of producing the most beneficial results both as it respects the Peasantry, the Landholders, the Europeans who engage in its promotion, and the country at large. It would tend to enlarge the ideas of the Peasantry, to dissipate their prejudices, to call forth their latent energies, to encourage their industry, and to promote their respectability and usefulness in society. It will be scarcely denied that the Peasantry of India are in a condition much below that in which the great body of English Farmers were *previously to the formation of Agricultural Societies there; and yet these farmers* have in many instances *learned the art of raising upon* the same land more than four times the *produce they formerly* raised, and to maintain themselves and their families in a much more reputable manner than they formerly did, notwithstanding the value of the land, and consequently its rent, have been quadrupled. The Landholders would soon feel the benefits arising from the labours of an Agricultural Society in the increasing value of their estates, the greater comfort and happiness of their tenants, and the gradual cessation of those mean arts too frequently practised, in order to evade the payment of their rents. And every European who engages in promoting the interests of his fellow-creatures in India, must feel a copious return of pleasure when he

witnesses the success of his endeavours: indeed there are few who would not realize a continual source of enjoyment in viewing the improvement of this country, the increasing respectability and happiness of its inhabitants, and the advancement of pursuits which are in every country the most friendly to human happiness.

By associating Native Gentlemen of landed estates with Europeans who have studied this subject, and have made observations upon the practice of Agriculture in different countries, we should gradually impart to them more correct ideas of the value of landed property, of the possibility of improving it, and of the best methods of accomplishing so desirable an end, and should at the same time convince them of the importance of studying the true interest of their tenantry, and introducing improvements on their estates. The draining of marshes, the cultivation of large tracts of country now not only useless, but the resort of savage beasts and the source of severe diseases—the improvement of stock—the creation of a larger quantity of the necessaries and conveniences of life, and of raw materials for manufactures—the gradual conquest of the indolence which in Asiatics is almost become a second nature,—and the introduction of habits of cleanliness, and a neat arrangement of domestic conveniences, in the place of squalid wretchedness, neglect, and confusion; in a word, of industry and virtue in the room of idleness and vice, might all, by an association of this nature in time become obviously important even to the natives themselves. These are some of the benefits upon which we may reasonably calculate as the consequences of an Agricultural Society in India; and every lover of mankind will undoubtedly acknowledge them to be such methods of doing good to his fellow-creatures as are worthy of his closest attention.

Were an Agricultural Society formed in India, its first endeavours should be directed to the obtaining of informa-

tion upon the almost innumerable subjects which present themselves; it would thereby gradually accumulate a stock of knowledge upon every subject connected with those inquiries, which when embodied would comprise the total of the present ideas, the experiments, the general practice, and the proposed plans of a great number of individuals, combined indeed with a history of errors, mistakes, and failures, which however, though injurious to the individuals who make them, would be of the utmost advantage to society.

Agriculture being of the first importance to all countries, the methods employed to raise crops, and conduct the other parts of rural economy must so vary with soil, climate, and other local circumstances, as to make it impossible for any individual to be practically acquainted with them all. Too much praise can scarcely be given to local establishments, whether public or private. They are of the greatest value in ascertaining the capability of particular districts to produce certain crops, and in making important trials of particular modes of culture; but it would be impossible to form establishments of this nature sufficiently extensive to admit those numerous experiments which must be applied to even a few of those diversified circumstances connected with the agriculture of a large empire, which comprises every variety of situation and climate. For though Divine Providence has so ordered it that most of the culmiferous plants, which are of the first importance as articles of food, are able to bear almost equally the severe winters of the north, and the burning heat of the torrid zone, yet the mode of cultivation must be greatly varied to insure success in these different climates. It is also obvious that many plants which furnish useful and valuable crops in one climate, cannot be cultivated in another, except as articles of curiosity; hence that variety of plants and trees capable of being cultivated in different parts of India, and of forming rich fields, luxuriant gardens and orchards, and valuable forests of timber; of

clothing the highest mountains and the deepest vallies, and overspreading the most extensive plains though composed of every variety of soil, renders necessary some plan which may stimulate and direct agricultural operations far more extensive than those which any local establishment can possibly embrace. By collecting the result of actual experiments and established practice in all situations, the members of an Agricultural Society would so embody and employ their accumulated information, as to make it contribute materially to the general good.

An Agricultural Society, among other things naturally presenting themselves, *would pay close attention to the Improvement of Land*, by encouraging a superior mode of cultivation, by ascertaining the best kinds of manure, and the best method of applying them, by encouraging neat workmanship, by draining, embankment, a proper rotation of crops, and a prudent management of stock, and by other methods which their united experience might suggest. It would be presumptuous to say that the mode of agriculture used in any country is brought to such perfection as to make all attempts to advance it unnecessary. There is nothing human which does not admit of improvement; how much then must remain to be done in a country where the same system, with scarcely a single variation, has been persisted in for many centuries! Indeed we may safely aver, that so far as regards improvement, almost every thing remains yet to be done.

It is only a few years since any tolerable information upon *the best method of properly cropping Land* and of the best rotations of crops in particular situations, was obtained in Europe, and it would be unfair therefore to suppose that any thing respecting it is known to the natives of India. In many parts of this country the same crop is invariably raised on the same ground year after year; and if ever an alteration is made, it depends more upon the kind of seed the

farmer happens to have by him, than upon the nature of the land, upon his wish to improve it. It is probable that the distinction between those crops which improve, and those which deteriorate the soil, is totally unknown in India, and that a scientific rotation of crops is a subject to which all cultivators are strangers. The same may be said of manure, the greatest part of which is generally consumed for fuel, without any idea of its value to enrich the soil, or of the quantity which ought to be used to produce the greatest effect.

Another object to be pursued by an Agricultural Society is, *the introduction of new and useful Plants.* That there are great numbers of plants suited to the soil and climate of India beside those already cultivated, no one will deny. The great and increasing demand made by the arts and manufactures upon the produce of the soil for particular productions, is such as to require a variety of plants suited to every soil, and calculated to furnish crops for all sorts of land; and it only requires the united efforts of public spirited men to bring these articles to notice, and encourage their cultivation.

The improvement of Implements of Husbandry, has occupied the attention of some of the first mechanics in Europe, in countries where, previously to these improvements, the meanest implement far surpassed the best which is to be found in India. This would naturally be an additional object of the Society now proposed. The Europe Plough and the Harrow, the Scythe and the Sickle, the Fork and the Rake, with the Cart to carry the produce of the soil to the Farmer's yard; and a great number of other desirable implements must, it is true, be introduced by slow degrees, and their utility clearly proved, so as to induce the indigent farmers of Hindoosthan to discern their usefulness, and ultimately adopt them in practice. But that they might thus be introduced there can remain little doubt.

No *attempt to improve Stock,* appears ever to have taken place in India, but every thing has been left to nature; there is however every reason to think that the breed of Horses, Cows, Sheep, Goats, Swine, and of every other useful animal, might be improved as effectually as it has been in other countries, were proper means employed to accomplish the end. The quantity of milk in cows might undoubtedly be increased, the quality of wool might be improved, a stronger and more useful race of cattle both for draught and burden might be gradually introduced, and in short every thing might be expected from persevering attempts to improve those animals which come under the denomination of stock, whether intended for Labour, the Dairy, or for Food. This then would form a proper object to call forth the exertions of an Agricultural Society.

But another object which it is exceedingly desirable to encourage, is, *the bringing of Waste Lands into a state of Cultivation.* The quantity of land in India now lying uncultivated, is so large as almost to exceed belief: extensive tracts on the banks of the numerous rivers, are annually overflowed, and produce little except long and coarse grass, scarcely eaten by cattle when young and tender, and never attempted to be made into hay, or to be turned to any useful account, that very small part excepted which is employed in thatching the houses of the natives. During the rains these tracts are the haunt of wild buffaloes, which in the night come up from them and devour the crops of rice on the higher lands, and in the cold season wild hogs, tigers, and other noxious animals unite with the buffaloes in occupying these pernicious wastes. The securing of these from inundation by embankments or by other methods, is an object of prime importance, as it respects the security and healthfulness of the country; and the increase of good meadows, or valuable arable land, would add greatly to its prosperity. The same observations will apply to the vast

tracts which are now wholly overrun with wood; and which being entirely neglected, and neither valuable as forest, pasture, nor arable land, subtract from the salubrity of the country, and prove a nuisance to the surrounding districts by affording shelter to great numbers of noxious animals.

In a country like India, where, even in those parts which have been longest under the British dominion, though ample security is given to the property of all, the oppressions of land-owners and petty officers are with difficulty restrained, where the cultivators of the soil are considered as mean and beneath the notice of the higher parts of the community, where indolence so pervades all ranks as to reduce the whole to an inert mass, and where, in all the districts not subject to Britain, the whole population has been constantly exposed to such flagrant injustice and oppression, that no one could reasonably promise himself security for a single night; it is natural to suppose that Agriculture should be in many parts entirely neglected, and in others partially followed, and that under great disadvantages. Thus one of the finest countries in the world, comprising almost every variety of climate and situation, diversified by hills and valleys, intersected in every part by streams, most of which, navigable six months in the year, and many of them through the whole year, afford every facility for carrying manure to the land and every part of the produce to market, as far as it respects its Agricultural interests, is in the most abject and degraded state.

It is also known and lamented that the state of Horticulture in this country is almost as low as that of Agriculture; so that except in the gardens of certain Europeans who at a great expense procure a few articles for the table, there is nothing to be met with beside a few wild herbs, or garden productions of the most inferior kind. All that is seen of orchards, amounts to no more than clumps of mango trees crowded together without judgment, and in which the quality of the fruit is but little consulted. The improvement of fruits

is almost neglected, and every thing which can contribute to the furnishing of our tables with wholesome and agreeable vegetables, and fine fruits, is yet to be commenced; not to mention that ornamental gardening is scarcely known. We depend upon Europe for seeds, of which, when we have obtained them at a great price, scarcely one in five hundred vegetables, and even after it has sprung up, seldom comes to perfection, through the ignorance or negligence of the native gardeners. It is notwithstanding, well known, that one part or other of India would suit every production, and bring every kind of seed to maturity, so that by a free communication, those parts of the country in which the seeds of particular plants do not come to perfection, might be easily supplied with them from others, and useful plants and fruits might be gradually acclimated so as to be plentiful in every part of India. The introduction of the potatoe, and more recently of the strawberry, are sufficient to shew that the attempts of insulated individuals have not been in vain. How much more then might be accomplished by the joint efforts of a number of persons ardüously engaged in the same pursuit!

The giving of premiums for successful cultivation, for neat and well managed work, for the improvement of waste lands, for the successful cultivation of a crop of any new and useful plant, the improvement of stock, and the invention or improvement of any implement of husbandry would, in all probability, contribute much to call forth the talents of the inhabitants of this country, and stimulate them to exertions, which would be necessarily followed by the desired improvements in a greater or less degree. By an Agricultural Society, premiums could be given to deserving individuals as a reward for such operations, as might be laid down in its rules. And as the only way by which improvements may be communicated and modes of culture made known is, by publishing reports of the proceedings of Societies, and communications from individuals describing either successful or

unsuccessful practice, it would be desirable that such a Society publish its Reports at stated periods in the English language, and in at least two of the languages of the country.

It seems highly desirable therefore that a Society should be formed in India, for the encouragement of both Agriculture and Horticulture, under any name which may be agreed on by gentlemen who may engage in its formation. The Funds requisite for carrying on its operations, might easily be furnished by each member's subscribing eight rupees quarterly, and any gentleman subscribing four hundred rupees might be a member for life. The business of the Society might be conducted by a President, two Vice-Presidents, and a Committee to be chosen annually. Each member might pay on his admission a sum of not less than a gold mohur. It is peculiarly desirable that Native gentlemen should be eligible as members of the Society, because one of its chief objects will be the improvement of their estates, and of the peasantry which reside thereon. They should therefore not only be eligible as members, but also as officers of the Society in precisely the same manner as Europeans.

On the Nature and Objects of the Agricultural Society, and suggestions on the best means of carrying them into effect. By Major Francis Jenkins, *Agent to the Governor General in Assam.*

The objects proposed in the formation of an Agricultural and Horticultural Society, were detailed in a Prospectus published at Serampore, April 15th, 1820, by Dr. Carey, copies of which were circulated through the country.

These embraced the encouragement both of Agriculture and Horticulture; but the former, as being by far the more important science, and perhaps the most neglected in this

country, was chiefly dwelt upon by the founder of the Institution.

The views of the Society were principally directed to the improvement of cultivation, of implements of husbandry, and of stock; the introduction of new and useful plants, and the bringing waste lands into culture.

As an essential means of effecting the objects of the Society, Dr. Carey proposed the association of Native Landholders as Members of the Society, and it was resolved, that all papers of the Society should be translated into the Native languages. The number of Native gentlemen, however, that have joined the Society, has been much less than might have been expected; and it will be very desirable that the influence of the Members should be used to prevail on their Native friends to associate with us.

The translations have been hitherto neglected, but steps have been taken to provide for them in Bengalee and Hindoostanee.

To ascertain the present state of Agriculture, was the necessary preliminary step, and circulars containing queries on the most important subjects were distributed over the country to European residents.

To the queries circulated by the Society, reports on the state of Agriculture of Allahabad, by Dr. Tytler, and of Huttah (?) by Mr. Stirling, of the 24-Pergunnahs, by Radakant Deb, and from Mr. Blake on the Agriculture of Poorneah, have been received and published in the Transactions; of which, that of Mr. Blake appears to be chiefly deserving the notice of the Agricultural Society, as embracing in detail the whole routine of farming in that district.

The other reports give more or less full information on the state of Husbandry in the different parts of the country described.

With regard to the improvements effected under the auspices of the Society, there appears to be no record; the

Society has, however, it is to be hoped, excited attention to Agriculture, and in that quarter in which it is most especially required, amongst our Native Members, and improvements will gradually follow, if our proceedings are not allowed to languish.

It is not easy to point out in what manner the Society can be most conducive to the views proposed in its institution; but by becoming the means of collecting and publishing the information of gentlemen, Natives and Europeans, scattered over the country, seems the most obvious mode of accomplishing Agricultural improvements.

I should therefore propose a re-circulation of the queries of Dr. Carey, with probably some additions which further experience may have suggested, in English, Hindee, Hindoostanee, and Bengalee, and the printing of communications made to the Society, with the least delay practicable, in numbers, instead of waiting to make up a volume; and it is to be hoped, we might be able to accomplish a half yearly number at least.

Another efficient means of forwarding the views of the Society, seems to me to present itself in the recommendation of local or branch Societies in communication with us. We should then be most likely to secure the co-operation of individuals placed in every variety of soil which the country exhibits, by allowing them to conduct their own operations, and to have the pleasure of perceiving and recording the benefit of their own local exertions.

To encourage the formation of Branch Societies, it will be, perhaps, essential to give up controul over their subscriptions, and for us to pledge ourselves to the appropriation of money entrusted to us to such purposes as they may direct; and the only assistance we should expect from them, would be a subscription from each of them, to enable us to publish the transactions of the Parent and Branch Societies for the benefit of all.

In the amount of their subscriptions, Branch Societies need not be regulated by the subscriptions of the Calcutta Society; but the sums to be appropriated to the general uses of the Society, and for remittance for seeds, should be forwarded to the Treasurer of the Society at periods fixed on, in communication with the Secretary.

Neither the funds of the Society, nor perhaps the state of the country will admit of premiums and exhibitions of ploughing and of implements and of stock, nor of examinations of estates, and of the excitements which have been so useful in England to elicit pride in the landholders in the superiority of their cattle, and of the culture of their farms; but the Society may be the means of communicating with the other presidencies of India, and with all foreign countries, and exchanging and importing grains and plants, and disseminating them through these provinces.

Much good, it appears to me, might be done in this way by the Society, and at very little expence; and I might say, that by the means of the individual Members of this Society, not a ship should leave the port without a commission to bring back something that might be of use to the country.

Grains should be brought from every country. Nothing is more likely to improve our crops than a frequent change of seeds, instead of perpetually sowing, as is now done, the seeds of each locality on the spot that produced them. The most esteemed rice of the Upper Provinces should be introduced into Bengal,* and vice versa; and so also the rice of the Co-

* This season, an active Member of our Society, Mr. Hurry, has brought down a considerable quantity of rice from Pillibeet, of three or more esteemed varieties for trial at Poorneah and in the neighbourhood of Calcutta; he has also introduced for the same purpose, some American paddy of a grain much larger than any we possess in this part of the country.

Ten years after the above note was written, viz. at a meeting held in July 1840, the Society was favoured by Mr. George Pratt, of Calcutta,

romandel and Malabar Coasts, on the former of which Dr. Roxburgh mentions somewhere, that he noted forty distinct varieties of rice; there should not be a variety untried. Of the importance of trying grains of foreign countries, Mr. Hurry mentions an instance, at a late Meeting of the Society. A gentleman had some grains of Indian corn from the West Indies, which were so much superior to our own grain of that sort, that he was offered by the ryots eight annas a grain for some thousand grains.

I need not mention the necessity of introducing and cultivating other kinds of cotton; there is little doubt but the enlightened proprietors of Saugor will, ere long, redeem this once staple commodity from its present disregard.

We might do much in improving our sugar canes, by the introduction of every esteemed foreign variety.

It is known, that intermixing the eggs of the silk worm of adjoining districts, tends to improve the produce of silk; and it seems probable, that the occasional importation of China, Italian, and French worms would be attended with advantage. The mulberry plant might also probably be improved in quality and quantity, by trying various kinds, and by experiments on its culture.*

with the successful result of some experiments made by him in 1830, while an Indigo Planter in Purneah, on a variety of Paddy, which was procured and forwarded by Mr. Hurry, from Baraset, in the neighbourhood of Calcutta. Mr. Pratt states, that at the period of his departure from Purneah, in 1836, this description of Rice, which had been found to be unusually productive, was cultivated to a considerable extent, and known in the district by the name of "*Belatee Dhan*," (English Rice.)

The above communication, and two others subsequently received from Messrs. Pratt and Hurry, are to be found in the monthly pamphlet of proceedings of the Society, for July and December, 1840, and January, 1841.—Ed.

* Since writing this, I have seen in the Report on the Progress of the Bombay Botanical Garden, a remark that our inferior silk is greatly owing to the inferior kind of mulberry we feed the worm on.

Nothing appears to me more susceptible of improvement than our silk, or of greater extent of production. The mulberry grows well along the edge of our Western jungles on stiff clayey ground that would produce no grain, and I should conceive, it might be cultivated successfully all over the high grounds to the West, which are now an uninterrupted waste for 500 miles.

There is no doubt that our sheep might easily be improved by crosses with the breeds of Australia, and the pasturing of them, at least, in the hill provinces of Ramghur, become a source of very profitable employment.

The weight of an ordinary fleece at home, of the improved breeds is from 6 to 10lbs.; whereas a corge of Bengal sheep, will only give five seers of wool, and a corge of large Up-Country sheep about double that quantity; and this in quality of the very worst description.*

Should grazing become of importance, the introduction of grasses, and making of hay from the natural grasses of the country, would be points for the Society's encouragement.†

There appears no indifference on the part of the Natives in any part of the country to their breeds of cattle, and we have amongst them some of the finest breeds of animals in the world; in size the Nagearee bullocks, in which the Up-Country gentlemen and *ladies* so much pride themselves are

* Saxon wool is, I believe, selling just now in England at from 2 to 4 or 5 shillings a lb.; English, at from 8*d.* to 1*s.* 4*d.*; the wool of the Bengallee sheep sells for two and a half rupees the maund; the wool of the Up-Country sheep fetches eight rupees the maund, and that of the Dhoomba and Hansi sheep about sixteen rupees; this wool is manufactured into the *looees* of the North Western Provinces.

† During the last six years the Society has given much attention to this object; more especially to the introduction and spread of that useful and nutritious variety, the *Guinea Grass;* by the transmission from its Nursery Garden, of roots and seeds to various parts of India.—Ed.

unequalled. The Sinde cow is little inferior to the best English cows in the quantity of milk they give, and they are the handsomest animals of the race I have ever met with. The oxen of Central India, (of Nagpore,) the red-spotted, are more active than the best North Devons. The strength, activity and beauty of the teams that drew our Artillery under Fairlie's contract, will be well known to every old officer in the service. The Hurrianah and Poorneah cattle are by no means despicable, and there is nothing but the total want of pasturage at periods of the year, and the extreme poverty of the ryots in many districts, which prevent the breeds of such districts from being improved by crosses with the superior kind before mentioned, and this state of things can only be altered by the assistance of the landlords, and the gradual amelioration of the condition of their peasants.

Perhaps nothing more deserves the particular attention of the Society than Fences.

In the Western Provinces especially, the destruction of grain from the want of fences, and the loss of labour in yearly planting dry fences, are enormous; less labour properly bestowed would secure permanent fences, and for which there are a very great variety of fit thorny plants to be met with in every jungle; viz. the wild karounda, the bubools, bamboos, the kurrunjah, the kedjoor, and numerous others, which would not only afford impassable hedges, but many very useful products; and above all, supply that great requisite in the Upper Provinces, firewood—the great dearth of which now not only presses so hardly upon the poor cultivator, but must effectually retard all improvement in cultivation, by the consequent consumption of all manure in fuel.

If this Society could introduce even a very partial adoption of fences, and could prevail on any of the great Native proprietors to enclose parts of their estates with substantial hedges of productive timber wood, and to encourage their tenants

to follow their example, we shall have conferred a benefit of no small amount upon the Agriculture of India.*

The greatest obstacles to the improvement of our lands are certainly want of manure, and of water: the burning of the litter of the cattle as a substitute for firewood, in the absence generally of the knowledge of the utility of the rotation of crops, occasions, throughout India, the raising of all the greater crops unassisted by manure, or by the application of more of the industry and science of man, than to effect the necessary breaking up of the land for the reception of seed; and in the Upper and Southern Provinces, of watering the plant occasionally. And we may say, that the crops of India are raised by irrigation, natural or artificial, alone; and in our part of India at least, there is no part of rural industry more mismanaged. In the Peninsula, and where artificial irrigation is essential to the production of the crops on which the bulk of the population depends, the formation and preservation of tanks have been for ages, objects of attention to the Government and the landholders, and I believe much skill and great labour are shewn in most parts of the country, in taking advantage of any favourable disposition of the ground for collecting falls of water, and of making them into artificial lakes, often of very great extent, and much economy evinced in the disposal of the waters to the fields. In Upper India, where the wheat crops are in part dependent on artificial irrigation, and mostly require unceasing watering for the last month or six weeks before harvest, the cultivators have made provision of wells, and in the Doab, can water nearly all the lands that are ever cultivated. But much water that might be procured with less trouble from tanks formed in the hollow grounds which frequently present themselves in the Doab, is allowed to run to waste; and many small jheels, which

* For an instance of the benefit likely to result from the carrying out of this suggestion of Major Jenkins, the reader is referred to the third page of "Correspondence and Selections," in this number.—Ed.

might have been bunded and made reservoirs of large quantities of water are neglected, and drained in the course of a very short period of the commencement of the dry weather, in watering wheat or sugar canes. The system of irrigation, and the method of raising water, might certainly be immensely extended and improved in all the wheat countries, and it will be the duty of this Society to devise and recommend means of doing so.

In Bengal, where in all usual seasons rice, the main crop of the country, is independent of all artificial watering, irrigation is almost wholly unknown.

A consequence is, that even a very partial failure of the rice is severely felt by the immense population of these provinces, as they have no resource in any dry weather crops from the want of the means of irrigating them; and without partial assistance from irrigation, it is probable few grains could be matured. I should conceive, however, that with more attention to the means of irrigating their fields, not only might considerable relief be obtained in cases of failure of the rice, from having recourse to the leguminous crops which are principally raised in the beginning of the cold weather; but that in all seasons, on the higher grounds, after cutting the rice, an after-crop of some of the various *dals* might profitably be raised; and perhaps even wheat and barley on many descriptions of soils. Last season, on the banks of the Dummoodah, near Rajbulhat, I observed there had been almost an entire failure of the rice, and there was no attempt to raise any substitute for it whatever. Although this was a very limited failure, yet a very great population, employed chiefly in raising silk, were suffering much deprivation; rice was selling at twenty-three seers for the rupee, which amounts to a scarcity, curtailing the poor of one-fourth, perhaps, of their usual quantity of food. Having no wells and no reservoirs of water of any capacity, they had scarcely a few vegetables; and though on the banks of the Dummoodah, whose waters

might have been dammed up, or any quantity of water obtained from excavations in its bed by the usual simple means adopted in other parts of India, even the mulberry trees were watered by hand.

The *dals* are considered as luxuries in all the rice countries, and the extended cultivation of them, would not only be some resource in seasons of failure; but improve the condition of the peasant, and by introducing a succession of crops, enforce habits of industry; for at present the rice crops, which require hardly any labour, are no sooner gathered, than the bulk of the population are devoid of any constant employment. The introduction of jooar and bajree, could not provide substitutes for rice being grown, as they are cultivated in the rains only; but I think it probable, they do not require the same quantity of water as the rice, and might be cultivated with advantage on dry lands which will not carry rice, and should this be the case; they would afford what is much required, the very finest fodder for cattle known in the country.

Within the last twelve or fifteen years, we have seen the potatoe, which was only grown before for the tables of Europeans, become so extensively used, as to be a considerable part of the food daily consumed by the poorest people in most parts of the country for four or five months in the year, and its cultivation is yearly increasing. At first, the potatoe was confined to the vicinity of Patna and Benares, and the soil and climate of Bengal were considered unfavourable to it; but there are now several varieties, and mostly very good, grown close to Calcutta,* and the supply is abundant, and our tables are furnished with this favorite vegetable the whole year round. The increased cultivation of the potatoe will perhaps do more to avert scarcity, and to improve the diet of the labouring poor, than that of any other productions;† and

* Particularly in parts of the Hooghly District.—Ed.

† See Major Twemlow's letter on this subject, at the first page of "Correspondence and Selections," in this number.—Ed.

the Society should particularly select it as the object of their medals and premiums.

The potatoe cannot be raised without calling forth all the industry of the cultivators; it requires manuring, frequent weeding, and hoeing, and constant watering, and whilst its produce amply repays all the labour bestowed upon it, the unremitting attention it calls forth, is equally improving the means of the ryots and their habits.

Many other tuberous roots may also deserve the attention of the Society; the West Indian Arrow-root for one, which has lately been introduced here, though for some years cultivated in Ceylon.

[Some explanation is deemed necessary by the Committee of Papers for the republication at the present time of the Prospectus of Dr. Carey, and the production of the Remarks of Major Jenkins, written more than ten years since. As more than twenty years have elapsed since the formation of the Society, and few of its first members at present exists, it was considered expedient again to direct the attention of the very large numbers of gentlemen of which it is now composed to the great objects contemplated in its formation, and to urge the absolute necessity of increased energy in carrying out the views so clearly and succinctly detailed in the Prospectus. Many of the suggestions contained in it have been successfully prosecuted, as may readily be ascertained by referring to the printed Transactions; but much still remains to be done, which requires the zealous co-operation of all who possess the means of forwarding the interests and improving the Agriculture of this country.

The quantity, as well as the quality of the original matter, which the Journal must contain, is so entirely dependent upon the communications of the many members of the Society scattered over the country, that the Committee of Papers are induced to hope, many will come forward with the results of their experience, which cannot fail to be useful and beneficial to the cause in which all are labouring. Plain, practical, well authenticated facts, and not theoretical speculations, however plausible, ingenious, and learned they may be—are alone required, by which the accumulated experience of intelligent and active observers will be preserved, and made known for the benefit of those who stand most in need of such information.]

Report of the Agricultural and Horticultural Society of India, for the year 1842.

Introductory Remarks.

Sensible of the advantages resulting from a retrospect of the labors which from year to year have engaged the attention of the Society, and in accordance with a practice which has obtained for the last six years, the executive have now the pleasure to furnish to their fellow Members of the Institution, a brief Report of the operations of the Agricultural and Horticultural Society of India, for the year 1842.

Economy of the Society.

To commence with matters more immediately connected with the internal economy of the Society, and on which its means of usefulness mainly depend, it cannot, nor is it desirable, that it should be kept out of view, that the statement now to be exhibited is not quite so encouraging as that which was incorporated in the Report of the last year. This falling off is, however, inconsiderable, and it is to be hoped, now that there is every prospect of the unfortunate discussions which have lately agitated the Society, to the exclusion of the legitimate objects which demand its attention, being terminated, that the course of affairs will resume its wonted serenity, and that the hiatus which has occurred may speedily be supplied, by the addition of new names, and the return to the ranks of the Society of some of its former Members.

Since the close of 1841, seventy-five new names have been added to the list. The loss from death has been rather more than that of last year, and the decrease from resignations (as above explained) has been considerable. There have been twenty-one deaths, and fifty-one resignations, in all seventy-two.

The following tabular statement affords full details, and represents, at the same time, an analysis of the constitution of the Society.

	In 16 former years.	In 1837.	In 1838.	In 1839.	In 1840.	In 1841.	In 1842.	Gross Total.	Total real number at the close of 1842, after deducting lapses.
Honorary Members, ...	6	1	0	1	0	2	0	10	9
Free Member, ...	0	0	0	0	0	0	1	1	1
Civilians in the Service of Govt.			11	27		19	21	198	160
Merchants and Traders, ..			28	15	19	13	18	160	119
Indigo and other Tropical Agriculturists, ...			43	23	27	21		167	115
Military Officers, ...			18	15	18	21		127	91
Medical ditto, ...			10	7	7	10		73	41
Asiatics, ...			7	1	7	8		51	39
Clergy, ...	5	2	2	1				12	4
Law Officers, ...	14	5	1	5				34	25
Miscellaneous, ...	0	0	3	0	2	0	2	7	7
	188	148	123	95	110	95	75	840	611

Of this number, forty-one are Members who have compounded for their subscriptions; eighty-nine are in Europe; nine are Honorary; and one (Mr. Speed) is a free Member; leaving four hundred and seventy-one, as the actual number of *paying* Members on the books of the Society.

Necrology.

It is a melancholy task at all times to advert to the changes which death annually effects; but this duty on the present occasion is rendered particularly so, when it is remembered, that during the past year, the Society has been called on to sustain a more than ordinary loss, by the demise, in the prime of life and usefulness, of its late lamented Secretary. In a short Report like this, any attempt to discuss his merits and worth can scarcely be expected; but the executive cannot allow this opportunity to pass, without bearing testimony to the zeal and industry, the courtesy, and gentlemanly demeanor, so conspicuously displayed by the late Dr. Spry. Following closely in the steps of his excellent predecessor, there is little doubt, had his life been spared, that much further good would have resulted to the Society, and through its medium to the Pub-

lic, from the untiring zeal which he brought to bear on all those operations with which the Society is connected.

Captain Thomas Bayles, Superintendent of the Government Cotton Farms in Bundlekund, had not been many months a Member, before death deprived the Society of one, who had taken an interest in its proceedings, and who, from the nature of his duties, was likely to have become an useful associate and correspondent.

The other Members who have been taken from the Society during the past year by death; are, Sir W. Macnaghten; Baboo Additchund Dutt; Mr. Kirchhoffer, Merchant of Calcutta; Mr. Haines, Indigo Planter; Mr. David Hare, of Calcutta; Mr. James Wood, of Calcutta; Mr. J. W. Cragg, Merchant of Calcutta; Mr. Geo. Hardie, Indigo Planter; the Nawaub Tahowerjung; Mr. Jas. Shaw, of the Civil Service; Mr. C. Fussell, Indigo Planter; Mr. A. Mornay, of Calcutta; Mr. G. Tayler, Indigo Planter; Mr. H. Stanley, of Calcutta; Mr. Archd. Drummond, Indigo Planter; Mr. Sim; Baboo Deenonath Dutt; Mr. W. Agnew, Indigo Planter; and Capt. A. J. Fraser.

Address to the Earl of Auckland.

Passing now to a brief consideration of the topics which have engaged the attention of the Society during the past twelve months, one of the first, is that connected with the address presented to the late Patron of the Institution. The Society recollects with gratitude the many benefits conferred by the Earl of Auckland, from the period of his arrival in India, when he consented to become its Patron, till the time of his departure. It would occupy too much space to enumerate the several valuable communications of a practical and useful nature, which were placed by him at the disposal of the Society, and which occupy a place in its Transactions and Proceedings. But the Society cannot forbear dwelling with pleasure on a privilege, which has, till lately, so materially assisted in promoting the useful objects of the Association, and given an

impetus to the circulation and diffusion of much valuable information ; viz. *the reception and transmission, free of postage, of all communications, letters, and packages, on the business of the Society.* The grant of this privilege, independent of all other considerations, is sufficient to mark the sense which his Lordship entertained of the benefits which the Society is endeavouring to confer on the country.

Testimonial to Sir Edward Ryan.

At the close of the last Annual Report, allusion was made to the resignation, in consequence of his departure for Europe, of the late President of the Society. To mark the sense entertained of his great services during his long tenure of office, it was proposed, that Sir Edward Ryan should be requested to sit for his portrait, to be hung in the new meeting room at the Metcalfe Hall. This request was assented to, the amount necessary for the purpose was speedily raised, and forwarded to England. In acknowledging the receipt thereof, Sir Edward intimated his intention of complying with the request of the Society on his return to England from the continent, sometime in the course of next year.

Medals and Prizes awarded by the Society.

For Cattle.

The next subject that calls for remark in the order of arrangement, is the adjudication of medals at the annual exhibition of Cattle, held on the 1st of February. On that occasion four gold medals, with four large and one small silver medal, were awarded, as follows: to Captain Frederick Raleigh, for the best imported cow of any denomination, a silver medal. To Messrs. Hunter and Co., for the best cross, the produce of an imported bull or cow with native stock, a gold medal. To Mr. F. B. Paton, for the best bull-calf of any denomination, calved in 1841, a gold medal. To Mr. G. F. McClintock, for the best cow-calf of any denomination, calved in 1841, a silver medal. To Mr. W. Anderson, for the best *specially* imported wooled merino ram, a gold medal. To Mr. William Storm, for the best imported wooled ram of any

denomination imported during 1841, a silver medal; also for the best wooled cross between an imported ram or ewe and indigenous stock, a gold medal; also for the second best wooled cross, a silver medal. To Mr. W. McIver, for the third best wooled cross between an imported ram or ewe and indigenous stock, a small silver medal.

At the annual Horticultural exhibition in January, small money prizes and silver medals were given, as usual, to the Market Gardeners, to encourage the continued improvement in the growth of European vegetables.

For Horticulture.

In the early part of the year, the Society was favoured by Mr. Ravenshaw, Commissioner of Patna, with a series of valuable communications connected with the Agricultural improvement of the districts of the Behar Province, together with the correspondence and suggestions of some of the Collectors on the same subject.

Agricultural Improvements in Behar.

To give support to these suggestions, it was resolved, at the meeting at which the correspondence was read, that the papers should be referred to the Agricultural Committee. Accordingly, at a subsequent meeting in May, the report of the Committee was submitted. The Members, [illegible] their several minutes, state, that they entirely agree as to the benefits to be derived from the carrying out of the suggestions recommended by Mr. Ravenshaw and the other Revenue Officers, in the establishment of Local Committees; the translation into Oordoo of practical papers bearing on the cultivation of the more useful staple articles; the distribution of all descriptions of seed among the Zemindars, and through them to their respective Ryots, and then point out how these measures may best be effected.

The Society, in confirming the report of its Committee, intimated, "that it very much approved of the suggestion of Mr. Ravenshaw, especially the application for pecuniary assistance from the Board of Revenue; and that it would be very happy to contribute its assistance in receiving and for-

warding seed, &c.; but that its funds did not admit of its incurring any expense." It was further intimated, that the despatch of the Honorable the Court of Directors to the Supreme Government, in which they state, "that they propose from time to time to print and publish such information as may come before them, calculated either to extend the knowledge of the productions of India, to increase their amount, improve their quality, or give a stimulus to the demand for them; and desiring, that the Governor General in Council will cause similar measures to be taken for effecting the same objects throughout India,"—would furnish grounds of support for any application that might be made for pecuniary aid in furthering translations or publications.

In pursuance of the assistance offered by the Society, a large supply of Carolina Paddy was despatched to the several Collectors in the Behar Province, and a few papers, explanatory of the culture of several products were, at his request, furnished to Mr. Ravenshaw, in order that they might be rendered into Oordoo, and distributed in the district. The Society has not been informed, whether, or to what extent, any of the other proposed measures has been carried out.

Cotton Cultivation.

On the subject of that great staple, Cotton, and on the operations which are now in progress, by Government, for promoting and extending its culture throughout India, the Society has received several communications from Dr. Wight, Superintendent of the Government Farms at Coimbatore, from the late Capt. Bayles, and from Mr. Finnie, American Planter, in charge of one of the Government Plantations in Bundlekund. Simultaneously with the receipt of these communications, the Society was favoured by Mr. Quintin, at Gya; by Dr. Irvine, at Gwalior; by Mr. Hamilton Bell, at Omeghur, near Agra; by Mr. Saunders, at Allyghur; by Mr. Lowther, at Allahabad; by the Agricultural Society of Allahabad; and by other

gentlemen in the interior, with accounts of the experiments made in their respective districts with the foreign Cotton Seed, received by them from this Institution.

Several of the reports furnished by the Cotton Committee, on the numerous samples which accompanied these communications, go to prove not only that much may be done by persevering in the growth of cotton from foreign seed, but that by a better system of culture and gathering, a great improvement may likewise be effected in the quality of the indigenous cottons of India.

Prize for improving the Indian Churka, or cotton-cleaning Machine.

It will doubtless be in the recollection of the Society, that about four years ago, Major Jenkins, the Commissioner of Assam, placed at its disposal the sum of 500 Rs., to promote the discovery of an efficient method of bringing the cocoons of the Eri Silk-worm into use as an article of commerce, and that the Society voted a similar sum towards the same object. Although the schedule of prizes was publicly brought to notice for the space of three years, one gentleman only sent in specimens to compete for the first prize, but the amount was not awarded, as the Silk Committee did not consider that the terms had been sufficiently complied with.

Taking into account the uncertainty of any further competition, Major Jenkins considered it would be desirable to transfer his prize to some other object. Since the American Saw Gin has been found to injure the staple of Indian grown cotton so much; and the iron churkas of Mr. Houldsworth of Glasgow, and Mr. Potter of Manchester, are deemed inefficient, and a good machine for cleaning cotton is still a great desideratum, it was determined, with the consent of Major Jenkins, that his contribution, and the Society's gold medal, should be offered to any person who may succeed in improving the Indian churka, so as to make an efficient and serviceable machine for cleaning cotton. This amount is accordingly before the public, for the purpose of encourag-

ing the manufacture of a machine, which cannot but prove exceedingly useful.

Tree Plantation in the North-Western Provinces.

With a view to stimulate further exertions towards the planting of trees in the North-west Provinces, Mr. H. C. Tucker, late Magistrate of Azimghur, in addition to a gold medal previously placed by him at the disposal of the Society, has transferred the sum of 300 Rupees, to be awarded to any person who shall shew the largest new plantation of Trees in the Agra Presidency, at the close of the year 1842.

The executive have much pleasure in bringing the circumstance thus prominently to notice, in the hope of assisting to effect the excellent object contemplated by the liberal and public-spirited donor.

Distribution of American Ploughs.

In the course of last year, the Society was furnished, through the liberality of Government, with fifty American Ploughs of a light construction, which were considered, with reference to the soil, and strength of the bullocks of the country, to be well adapted for trial, and extended introduction in Bengal, and in some portions of the Upper Provinces. It is with pleasure the executive mention, that the demand by Indigo Planters, and Agriculturists generally, for these implements, has been so great, that it has much exceeded the supply. The Society was the medium of procuring for the late Capt. Bayles, a large number of Ploughs of a similar construction, which were manufactured by Messrs. Jessop and Co. of Calcutta, and forwarded for the use of the Government Cotton Farms in Bundlekund. From reports hitherto received, it would appear that it has, in the Gorruckpore district especially, with some slight alteration, been found to answer exceedingly well. The executive hope to be favoured with further reports from those gentlemen to whom these implements have been given, in order that a fair estimate of its capabilities may be formed. As far as simplicity of manufacture, lightness, and

cheapness are concerned, it is most probable, that this description of Plough will be found to answer much better than the instruments hitherto imported from England and elsewhere.

Formation of an Agricultural Society at Ceylon.

The commencement of the year witnessed the formation of a Society at Ceylon, for the purpose of promoting Agricultural pursuits in all its branches in that island. This gratifying announcement was communicated to your Society at its general meeting in March, when a complete set of its Transactions was directed to be presented, and a varied assortment of seed was subsequently sent to Ceylon, as an earnest of the wish of this Institution to co-operate in every way in the work of amelioration.

The late great influx of European Planters into the island, is not only likely to prove, through the combined influence of capital, skill, and industry, the means of developing, in a greater degree, its agricultural capabilities for the production of many of the more usual articles of commerce; but will doubtless be the means of extending considerably the operations of this newly-formed Association.

Agricultural Department. Foreign Cotton Seed and Carolina Paddy.

In order to meet the many demands from Members, and the Public generally, for seed of an agricultural description, the Society in continuation of its efforts for many years past, has imported large quantities of Cotton Seed from America, through the friendly agency of Dr. Huffnagle, an Honorary Member of the Association, and the late Capt. Bayles. A portion of these supplies has been disposed off, but sufficient is still on hand for future distribution.

The Carolina Paddy, of which a consignment was received in the middle of the year, has been much sought after. By letters from Capt. Bogle, Commissioner of Arracan, it would appear, that much good may be expected to result from its introduction into that Province. The executive think they cannot do better than quote the very words employed by

Capt. Bogle, when writing on the subject. He says, "I wish you would send me much more of the Carolina Rice, if you have it to spare; I am in great hopes that it may be possible to reap two crops per annum of it, which would be doubling our agricultural riches. I am so perfectly satisfied of the great importance of introducing this grain into Arracan, and of the ease with which it may be accomplished, that if I had the power, I would throw *one hundred maunds* of seed into the Province every year for the next *five*, which, in addition to the produce of the seed, which should be kept for seed, would create a great change. The people here approve of it highly, and it would, I am sure, in a few years supersede the coarse and inferior grain of this province; for, besides being esteemed by consumers, it yields exceedingly plentiful returns. I do not know that we can do any thing better in Arracan at present, than devote attention to the improvement of rice, which is the great staple of the country." Of the value of its introduction in other parts of Bengal, some idea may be formed from the circumstance of a small supply which was forwarded to Bogra, (a large rice district,) being considered so acceptable, that Mr. Payter, an Indigo Planter, resident there, states, that although the rice grown there is of a superior sort, yet if the Carolina Rice could be extensively introduced, it would doubtless, in the course of four or five years, be the only sort cultivated, and become a staple export of the district.

Horticultural Department. Garden Seeds and English Fruit Trees.

In the Horticultural Department, seeds have been imported from England, America, and the Cape, and distributed all over the country. The consignments from the two latter places appear to have given satisfaction, but the seeds from England have again occasioned disappointment, notwithstanding the care and attention bestowed by Professor Royle. It has accordingly been determined to discontinue the supply from that quarter, and increase the consignments from the other countries.

tution. Here it may not be out of place to allude to a communication with which the Society was favoured by Dr. Falconer, Superintendent of the Botanic Garden at Saharunpore, in which he states the safe arrival at that station of a case of fruit tree grafts, which were transmitted to him in the early part of the year, by the Society. This, Dr. Falconer says, has been undoubtedly the most successful despatch of fruit trees from England that has yet reached Upper India; numerous consignments had been sent to him before, but hardly one of them ever reached alive. The plants thus secured, were immediately forwarded by Dr. Falconer to the Mussooree Garden. Judging from this successful attempt, Dr. Falconer considers August would be the best month for despatching from England any plants intended for the North West Provinces.

Nursery.

From the Nursery of the Society, the Sugar Cane distribution this season has not been so great as the last; the severe gale which was experienced in the early part of June, having caused great damage to the cultivation. The other useful cultures have met with attention, among these may be noticed the Guinea Grass and Morus Multicaulis; roots and seeds of the former, and many cuttings of the latter, have been given to applicants during the year. The Overseer's bungalow, for which a sum of money was voted, as mentioned in the last report, has been erected: the total cost has amounted to eleven hundred rupees.

Literary Department.

A great change has been effected in the Literary Department, by the adoption of a Monthly Journal in lieu of the Monthly Report of Proceedings and Annual Volume of Transactions. Although the little brochure of proceedings was the means of affording rapid publicity to the subjects which engaged the attention of the

Society at its Monthly Meetings, yet it was not found practicable to give insertion to many valuable, but lengthy communications. These papers were consequently reserved for the Transactions, and were not presented to the public for several months, in some instances a year, after their receipt by the Society.

With a view to remedy this, and to afford early publicity to every communication presented to the Institution, it was considered desirable, that a change should be made in this department of its labors ; and few, if any other mode, offering greater advantages than a Monthly Journal, it was after some discussion, ultimately agreed to adopt that form of publication. The first number, for August, was published in the middle of that month, and has been succeeded by four others to the end of December ; thus completing the first volume of the work, with the close of the year.

Bust to the Memory of the Founder of the Society.

In the Report for 1840, full details are afforded of the preliminary arrangements which were made for the erection of an edifice to be designated the "Metcalfe Hall," in the lower story of which building the business of the Society is to be hereafter conducted. There being every prospect of the Institution thus possessing a more appropriate and extensive locale, it was conceived that a favorable opportunity presented itself to the Society, to pay some permanent tribute of respect to the memory of its venerable founder. Accordingly, at the suggestion of Dr. Wallich, the Senior Vice-President, at the general meeting in July, it was proposed that a subscription be raised from among the Members, to erect a marble bust of the late Rev. Dr. William Carey, to be placed in the new apartments at the Metcalfe Hall. This suggestion was unanimously adopted, and the requisite arrangements have been made to give effect to the proposition.

Government withdrawal of free Postage.

Having already recorded their sense of the importance of the privilege which was granted by the late Patron, the Earl of Auckland, in the re-

mission of postage on all subjects connected with the Society, it is with feelings of corresponding regret the executive have now to allude to the late withdrawal of this boon, whereby it is to be feared, and reasonably expected, that the exertions of many Members of the Association will be materially lessened, if not altogether impeded. To meet the exigency in part, it has been voted, that such amount as may be necessary, on account of postage for the transmission of its Journal and Correspondence, be defrayed from the funds of the Society: this alone, it is estimated, will exceed one thousand rupees per annum. There still remains the transmission of *Agricultural** seeds, for which no provision can be made, (except occasional despatches by steamers,) as the expence of conveyance would form so considerable an addition to the prime cost incurred by the Society, and the charge of postage previously alluded to. These despatches have been mostly forwarded for the purpose of public distribution, it is not therefore probable that those zealous and public-spirited Members, who have hitherto rendered their assistance in this respect, will now be disposed to meet the heavy charge of bhangy conveyance from their private resources. It is consequently greatly to be feared, that thus much of the usefulness of the Institution will be curtailed.

Acknowledgments to Correspondents.

The Society takes this opportunity of acknowledging its obligations to its correspondents for their several communications. More particularly to Dr. Thompson, Deputy Inspector General of Hospitals, for some interesting details relative to his experiments in Cotton culture at Sydney, and for his paper on the Cane termed Otaheite, but which is supposed to be identical with the yellow Batavia Cane; to Dr. John McCosh, for his suggestions for improving the Ferries of Bengal; to Dr. Campbell,

* *Horticultural* seeds being generally for private use, have been forwarded, *bearing* bhangy charge to the parties requiring them.

Superintendent of Darjeeling, for his correspondence with Government relative to the manufacture of Nipal Paper at Darjeeling; to Mr. J. H. Bridgman, for his account of experiments made in the Gorruckpore district on Cereal Grains obtained from Europe; to Major Sleeman and Mr. Charles Fraser, the present and late Agents to the Governor General in Bundlekund, for some interesting particulars regarding the Chundaree Cotton; to Dr. Thomas Smith, Civil Surgeon at Bangalore, for his account of the introduction and spread of Silk culture in the Mysore country; to Professor Mouat, for his analysis of soils from Sandoway; and to a "West India Planter," for his observations on the present imperfect mode of cultivating Sugar Cane, and manufacturing Sugar in India. To the Government the Institution is also indebted for some valuable papers, regarding the culture of the Tea Plant at Kumaon and Gurhwal, and an account of the East India Company's Assam Tea Investment for the present year.

The Society cannot better quit this subject, than by requesting the further co-operation of its correspondents, and by inviting contributions from the many Indigo Planters and Agriculturists, resident in various parts of the country. It is with much regret the executive allude to the little assistance, in this respect, which the Institution has derived from gentlemen, who are supposed, from the nature of their pursuits, to be the best qualified to afford information on those subjects to which the attention of the Society is more particularly directed. Let each Member consent to contribute any little item of information founded on facts, and the result of his own experience; however unimportant it may appear to him, it would prove of much service, for not only would such an example induce others to follow his steps, but "in the course of a short time a body of important observations will be collected, which will tend alike to the advance of Agriculture in India, the honor and pros-

perity of the Society, and the credit of the individuals communicating them."

The thanks of the Society are specially due to Professor Royle, (an Honorary Member of the Institution,) for the warm interest he has evinced in its welfare, as evidenced in the continued assistance he has rendered in all matters in which his co-operation has been requested. The Society takes this opportunity of more particularly recording its sense of obligation to that gentleman.

Acknowledgment to Professor Royle.

In closing this brief review of the objects that have occupied its attention, the Society would earnestly request the active co-operation of all who take an interest in its proceedings, and conceive those proceedings to be conducive in drawing forth the agricultural resources of the country; and it further trusts that every Member, impressed with a similar feeling, will afford his individual aid and influence to promote the welfare and prosperity of the Agricultural and Horticultural Society of India.

Concluding Remarks.

Report regarding the Arundo Arenaria, Cactus Plants and Cochineal Insects, transmitted in March 1841, *to the Public Gardens at Secundra, with suggestions as to the best means of sending them safely in future.*

In the year 1841, a correspondence took place between the Agra and Supreme Governments, regarding the causes of the death of certain specimens of the Cactus plant and Cochineal insect, which were forwarded to the Upper Provinces in the Steamer "*Jellinghee,*" by the late Dr. Spry, on the part of the Agricultural Society, and also of the "Arundo Arenaria," brought out to this country by Captain Tremenheere of the Bengal Engineers, and transmitted by Dr. Wallich. The whole of these valuable specimens, with a solitary exception, perished *en route*; but as it was considered expedient to make a further trial to introduce the Cochineal

insect into the North-West Provinces, Dr. Falconer, Superintendent of the Saharunpore Gardens, wrote on the 4th June 1841, as follows upon the subject :—

"1. In reference to the correspondence regarding the Arundo Arenaria or Murrain Sand Reed, and the Cochineal insects and Cactus plants dispatched from Calcutta for trial in the Public Garden in Secundra, under Mr. Kaine, I have the honor to inform you, that I have this day received a communication from that officer, dated the 30th ultimo, intimating that the chests containing those valuable articles had been received on the 18th idem at Agra, but that the whole of the contents in both cases were unfortunately dead.

2. "Mr. Kaine, in his letter under reference, (an extract of which is annexed,) enters fully into the details of the condition in which the articles arrived, and gives it as his opinion, that the Cactus plants with the Cochineal insects, died in consequence of their having been forwarded in closed cases, preventing the access of fresh air; and he extends the same mode of reasoning to the bell glass over the Murrain Plants. I am by no means, however, prepared to concur in Mr. Kaine's deductions and sweeping arguments against 'Ward's' plan of glazed air-tight cases for transporting plants, which general experience in all quarters of the globe has proved to be one of the most important and successful improvements achieved in modern times in matters relating to Horticulture; nor am I prepared, without information as to the circumstances under which the chests were placed in their transport up the river, to enlighten the Government in regard to the causes of the very disastrous result which has ensued to the Cochineal materials and the Murrain Reed on the present occasion.

3. "A similar issue has so frequently occurred in other instances with plants in transit up the river, that I am anxious to direct the attention of the Government to the subject. The most disheartening mortality very generally takes place.

Of 20,000 tea seedlings dispatched from the Presidency Botanic Garden early on the rains of 1835, 90 per cent. died between Calcutta and Gurmucktesur, where they arrived in the month of December. The plants in this instance were forwarded by boat, contained in open boxes and pots. On another occasion, four air-tight cases with glazed lids, after 'Ward's' plan, containing tea seedlings, were forwarded by steamer to Allahabad, and thence by boat to Gurmucktesur, not one of which reached their destination alive. On other occasions, grafted fruit trees sent out from England for the Botanic Garden, Saharunpoor, by Messrs. Loddiges and Co. have reached Calcutta alive, packed according to 'Ward's' method, and afterwards been forwarded by steamer and boat to Saharunpoor, but in no single instance has one of them been received alive. As bearing on the same important point, I may be pardoned for stating, that I have lately been inquired of by Major Sleeman, so well known for his zealous labours in Horticulture, whether there was any foundation for a strange statement which had been made to him, that the Ganges water was destructive of plants sent up or down the river, and that they ought to be treated with well water; the constant cases of failure, having led native observers to this ready, though probably, very erroneous conclusion.

4. "On the other hand, large dispatches of the plants, hardy and tender, are transmitted from England to India, and *vice versa* with perfect success, packed up in the closed cases, notwithstanding that they are exposed to every vicissitude of temperature during a voyage of four months, which circumstance affords a fair presumption for entertaining the belief, that the nearly constant failures with the same plan in transit up the river, is owing to something defective in the management of the cases on board the boats. On the present occasion, the loss is very serious. There are no other materials in the country to replace the Murrain plants brought out with such care by Capt. Tremenheere; and the very impor-

tant experiment of the Cochineal at Agra, must be deferred till a fresh supply of the plant and insect is received.

5. "I beg leave respectfully to suggest, that in order to ascertain the cause of this disastrous result, and if possible, guard against its recurrence in future, enquiries be instituted as to the state in which the plants in both instances were dispatched from Calcutta; where they were placed on board the steamer, whether in the hold or freely exposed to the sun; in what condition they were landed at Allahabad; how long they remained there; and where the cases were placed, whether in the shade or in the open air; the same queries to apply to their treatment in transit from Allahabad to Agra.

6. "I would beg leave further to suggest, that in case of any valuable dispatch of plants being forwarded from the Presidency Garden, or the Agricultural and Horticultural Society at Calcutta, a responsible gardener be invariably sent along with them in continuous charge, till they are landed at their ultimate destination at Agra and Saharunpoor.

7. "I beg also to direct the attention of His Honor the Lieut. Governor to the circumstance, that a fresh supply of the Murrain Reed and Cochineal Insects is required for the desired experiments at Agra, and to suggest, that a requisition be made to this effect to the Supreme Government."

Extract of a letter from Mr. KAINE, *in charge of the Public Gardens, Agra, addressed to Dr.* FALCONER, *dated Agra, 30th May,* 1841.

"I beg to acquaint you, that the two chests containing the Cochineal and Sand Grass arrived on the 8th instant; the whole were unfortunately dead, not so much as a live thing was in the chest. I impute the death of the Cactus, and consequently the Insects to the want of air; they were in what is called a glazed plant chest, and were fastened at the top with screw nails, so that no air could be admitted. The

chest had been filled with the plant completely covered with insects, and when I opened it, the confined air within stunk from the decomposed vegetable matter; only one leaf that had fallen on some cross-bars had retained its original verdant colour. Should you get intimation of another despatch from the same quarter, have the goodness to have it brought by dâk bhangy. The history of the insect and its season of copulation being known by the sender, it may be forwarded to this station before or after that time with the greatest prospect of success, and this mode of transmission should not be confined to the Cactus alone, but should extend to all rare plants, particularly those from a foreign country. The seaside mat grass, Arundo Arenaria, was planted in two compartments in the same chest, one was under a bell glass, such as are used in Europe for propagating heath myrtles, etc. and was luted down with putty in such a manner as to prevent the access or admission of air, and retained the effluvia arising from the soil and decayed members of the plants within. That mode, in my opinion, is objectionable. I am aware that the bell glass may be made very useful in the transmission of plants, but air should never be entirely excluded; it does not follow, that although we can propagate but few exotics in Europe without its assistance, that a healthy growing plant would live for a long period under its exclusiveness; it is found necessary in the former case, even with the smallest cutting, to take the glass off for an hour once a day, and carefully wipe off the vapour or dew that may have adhered to its sides. The other half of the chest had free access to the air without better success; that however does not invalidate the above remarks with regard to the closed bell glass. The bhangy is the only means to insure the life of tender plants. One-third of the well potted and established plants of the Calcutta Botanic Garden die when sent on the river so far as this station."

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. II.—1843.—Vol. II.

The Sugar Planter's Companion.

By L. Wray, Goruckpore.

TABLE OF CONTENTS.

Introduction.—In attempting to supply a work of this nature to my brother Planters, and the Public generally, I have only in view, the benefit which I trust may be derived from its contents.

If it prove useful, in however slight a degree, I shall be amply repaid for the trouble it has cost me.

I must beg to enlist the kindly feelings of my readers as I stumble through my task. Very many, I doubt not, will be its errors, yet not so numerous, I flatter myself, as to exhaust their store of kindness.

I am sorry to say, I have hitherto found a very strong prejudice to exist amongst Europeans in this country, against the West Indian mode of cultivation and manufacture of the Cane. They seem to prefer the native system, with all its faults. I lived as a Planter ten years in the West Indies, yet am not so perfectly biassed, as to be incapable of making allowances for difference of soil, climate, seasons, &c. &c. &c. An ENTIRE change in the East Indian method, would be as unreasonable and difficult, as prejudicial and unsuitable. The true course is to cull from each system, *that*, which is valuable and easy of adoption, and by engrafting one on the other, ensure to ourselves such successful results, as would be vain to look for, from *either*, pursued *separately*.

But even this beneficial combination is often mistrusted and rejected. Misconception arising from want of proper information, appears to have kept alive this groundless fear; and happy shall I be, if the demonstrations contained in the succeeding pages, shall serve to remove it.

To induce the poor Native cultivator to abandon his old and well-known system, on a sudden, is impossible; but let him see for two, three, or four years, the success attending a different method, and we may be certain, that he will venture on the experiment.

Likely enough it will be in a very small way at first, but if corresponding profit attend it, he will by degrees increase it, as far as his means will allow.

Throughout this work, I shall endeavour to explain myself in as simple and concise a style as possible. Where technicalities do occur, they will be found to be indispensable, as in quotations, or when treating on subjects, which admit of no other mode of expression.

The authors whom I bring forward, are well known, and their works easy to be obtained. Amongst them, the name of Dr. Justus Liebig stands pre-eminent, in connection with agriculture.

" At a meeting of the Chemical Section of the British Association for the advancement of Science, it was determined, in order to benefit the Agricultural interests of the country, to have a work drawn up, reporting the state of Organic Chemistry. With admirable judgment they chose Dr. Liebig to perform this honorable task ; a task which he has accomplished with infinite credit to himself, and unbounded satisfaction to the Association."

In treating of soils, &c. &c. therefore, I beg to call particular attention to the learned Doctor's views on the subject ; views not formed on the baseless fabric of conjecture, but resulting from numerous experiments and extensive experience.

A SUGAR ESTATE.

In the settlement of a Sugar Estate, one of the greatest objects is to have the whole of the cultivation as concentrated as possible ; " the *works*" being the centre. By this an immense saving is effected in the casting of canes, manure, &c. An unwieldy cultivation should always be avoided ; better to have 500 begahs pucka, of Cane, as the whole of an estate, than some two or three thousand, which cannot be properly manured and attended to.

If it be an *object of anxiety*, to have a cultivation of that extent, then I would advise the construction of a set of *works* to every 500 begahs, each forming a distinct estate.

The next point to be secured is—water ; for irrigation, and water-carriage. Labour in abundance must also be procurable, and amongst other advantages, freedom from white-ants, wild elephants, and other animals. is particularly important.

Having obtained a favourable situation for an estate, mark off a spot in the centre for "the *works,*" make your cart roads, and plant out your cane. *But!!* in the erection of your *works,* practice the strictest economy prudence will allow of; carefully avoid building those immense straggling masses of brick and mortar, which if they don't ruin one in the actual cost, will not fail to absorb your capital, and act as a continual drain on your resources. On this point, I would most earnestly advise, *small* and *compact* manufactories, on a plan, the sketch of which will be given in a succeeding Number. Allowing that they* do not last more than five or six years, yet I imagine that will content any one who has been successful; whilst, if otherwise, the unfortunate, will think of dropping the cultivation altogether by that time.

One fact ought to be constantly in remembrance; viz., that although the cultivation and manufacture of Sugar Cane by Europeans, has been attended with astonishing success in *other* countries, such has been by no means the case in *India.* On the contrary, sorry am I to record it, many and extensive HAVE been the failures and losses; whatever the causes may be, which influenced them. I may therefore with justice say, that so far as Europeans are concerned, it may *still* be considered as *experimental.* This fact dictates prudent economy, and cautious management. Should this lead us to success, we could afterwards make our calculations with some approach to certainty; the character of the thing would be entirely changed, buildings and expensive machinery would be erected, capital embarked without fear and trembling, and "India" alone, would soon be able to supply all Europe with sugar.

When we come to the chapter on "the *works,*" ample information will be given on the subject.

* The buildings.

THE SUGAR CANE, AND A DESCRIPTION OF THE MOST VALUED VARIETIES KNOWN, ETC. ETC.

The history of the Cane has so often been given, that it will suffice here to mention, that on the best authority it is pronounced a native of both China and India. The Malabar Coast and the Islands of the South Pacific, seem also to lay claim to the same distinction, the arguments attending which it is not material to bring forward.

Amongst the different varieties of the Cane, the Bourbon, Otaheite, and Batavia rank highest, and are particularly valuable by reason of the abundance and richness of their juices. Next follow the superior kinds of Native Canes, the Chinese, &c. &c., each being of greater or less value, as the situation, climate, soil, and seasons vary.

"The Bourbon," was introduced into the West India Island, from the Isle de Bourbon, but came originally from the Coast of Malabar, where it was found growing spontaneously. When first taken to the Isle de Bourbon, it is stated to have been a small sized, but soft and juicy cane. By cultivation it, however, increased wonderfully in size and richness of juice, which speedily caused it to be generally cultivated in preference to the old species, until at length it entirely superseded them throughout the Island. This in fact has been the case, in a great measure, wherever it has been introduced.

Its good qualities do not consist merely in its rich juice and large size, but it has a degree of hardihood in its nature, which renders it extremely valuable; for instance, during seasons of long continued drought, if the soil in which it is planted, be congenial, no species of cane, (save the Otaheite,) can so long withstand its destructive influence. Again, an insect denominated the borer, which frequently commits great ravages amongst the Canes in the West Indies, is found to affect this very slightly.

This variety of Cane and the yellow Otaheite are so much alike in all respects, and have become so intermixed on West Indian plantations, that it is a matter of some difficulty to distinguish between them: the Bourbon, however, greatly predominates.

Of Otaheite Cane, there are two varieties which I am acquainted with; these comprise the yellow, or straw-coloured, and the striped. This latter which has broad, purple stripes, is a little inferior in size to the former. In appearance it is very similar to the Ribbon Cane of Batavia, the difference being, in its greater size and the colour of its stripes, which in the Batavian is of a blood red, on a transparent straw-coloured ground. This Cane is now to be seen, I believe, in the Society's Garden, Calcutta.

When Captain Cook first visited the Island of Otaheite, he found these canes growing in the greatest abundance and luxuriance; but, whether they really are indigenous or not, I leave to be argued elsewhere.

From Otaheite they were taken to the West India Islands, and have, together with the Bourbon, become the most esteemed of all Canes.

The produce per acre, yielded by these valuable descriptions, is very great, and may well astonish any one not acquainted with the fact.

With the advantages of a good soil and season, plants of the first year's growth often attain the height of twelve to fourteen feet, measuring six inches in circumference, and with joints eight or nine inches long. Two and half tons of sugar per acre, are very commonly obtained in Jamaica. Even as much as *three* tons, are not unfrequently produced. But the general calculation amongst the planters is, however, two tons from each acre of "*plant canes*," that is, canes of the first year's growth. Thus the manager of a Jamaica estate, would, on making his estimate for the ensuing crop, look chiefly to his field of *plants*, for instance,—an

estate of 200 acres in cane, would very probably run thus :—

50	Acres	Plants,	=	100	Tons.
50	do.	1st Rattoons,	=	50	do.
50	do.	2nd do.	=	30	do.
50	do.	3rd do.	=	20	do.
Total 200	Acres		Total Crop	200	Tons.

Twisted at the proper seasons, as will be treated of hereafter, they often attain maturity in ten months, but very rarely exceeding eleven or twelve. This variation depends, of course, on the climate and season. These canes require a generous soil, careful fencing, and attentive management. Many soils which agree with *other* varieties, are unfit for their proper developement, whilst it is generally remarked, that they are more sensible of the injuries committed by the trespassing of cattle, &c. during their early growth, than other descriptions. The foliage of the Bourbon and yellow Otaheite is of a pale green, leaves broad and drooping much, and on arriving at maturity frequently arrows or flowers, especially on estates having a sea aspect. This renders it, when in extensive fields, exceedingly ornamental and graceful in appearance. The striped cane is darker in the colour of its leaves, and with less droop.

The Bourbon and Otaheite have been introduced many years into India, but from some strange cause, they are in great disrepute. Many persons I am acquainted with, after having for some time cultivated them largely, have reverted to the Native canes in despair. One highly intelligent planter informed me, that for two or three years, they succeeded admirably with him; *but* a dry season came, and they were literally eaten out of the ground and destroyed by white ants. This is by no means a solitary case. My own experience in this country has been but short, yet as far as it goes, I give it.

In January 1842, I planted here, four begahs in Otaheite, of which about a fourth part escaped. This by constant irrigation produced very fine canes, and sufficed this year to plant out and supply fifty begahs pucka. Two patches, one seven and the other five begahs, sown *immediately after* the rains, came up as fine as any I ever saw in Jamaica, and even now, notwithstanding the cold, are as healthy and vigorous as I can wish, with strong sprouts daily shooting up. Another field of about eight begahs, which I planted in March last, was entirely destroyed by white ants; even ten roots were not saved.

The fields of Native cane adjoining, shared the same fate, and to the same extent. These lands, however, had been just recovered from the jungle, and swarmed with white ants; here therefore the cane had not a fair chance by any means. For my own part, I must have repeated instances of its signal failure, before I can be brought to turn my back on such valuable canes as the Bourbon and Otaheite.

Their rapidity of growth is astonishing at this place, (Goruckpore.) In the early part of September, I cut a small patch for planting out, and the rattoons of that portion are now (only five months) upwards of ten feet high, shewing good five to six feet of cane fit for the mill; thus yielding two cuttings in the short space of thirteen months. Cutting during the rains, however, would by no means be proper, if the canes are required for the mill, as at that period they are very watery, and almost deficient in saccharine matter.

The Batavian canes, with which I am acquainted, are of three descriptions; viz. the yellow violet, the purple violet, or Java cane, and the transparent or ribbon cane. The *yellow violet,* so denominated in the West Indies, differs from the Bourbon and Otaheite, in being smaller, less juicy, considerably harder, of slower growth, and with foliage much darker and more erect. When ripe, it is usually of a straw-colour,

its skin or rind is thick, and the pith hard; but its juice is rich, and tolerably abundant.

It is seldom that this cane arrows, but when it *does* so, it emits a faint, but agreeable fragrance, especially in the evening after a slight shower of rain, at which time it is particularly pleasing, and may readily be smelt even at a distance. Many persons have pronounced it extremely similar to the perfume of a violet bank, from which circumstance, probably, it has derived its name. The yellow violet does not require so rich a soil as those already treated of, but contents itself with that of an inferior description. This renders it of much importance in planting out large tracts of land, some portions of which may be too poor for its superiors. In Jamaica, it is usual, in such places, to plant the violet.

Thus we often see large patches of it flourishing in the midst of a field of Bourbon. To an unpractised eye, this sight would cause much speculation, as its dark green foliage presents a striking contrast to the pale green of its neighbours, which might lead to the conclusion, that these dark green spots were occasioned by some greater degree of fertility and moisture existing in those parts, whereas the contrary is in fact the case.

The sugar manufactured from this cane is of very fine quality, but by Jamaica planters it is commonly mixed with Bourbon plants, according to proportion, for the purpose of rectifying the juice of the latter. This mixture gives excellent sugar.

The PURPLE VIOLET, OR LARGE JAVA CANE, is fully as thick as the Bourbon, with joints from three to six inches long. In height it ranges from eight to ten feet, and the upper parts of the stalk often exhibit faint streaks, which are imperceptible in the lower joints, which are of a pure purple colour. The leaves are of a darker green than the yellow violet.

When ripe and in perfection, it yields a juice generally esteemed more sweet and rich than that of any other description of cane; but being hard, and comparatively dry, it is more difficult to grind, and affords only a small quantity of juice. It is very hardy, and thrives well in poor, dry soils, whilst it is often planted in the outer rows of the cane fields, as a protection against stray cattle, which browsing along the roads, and at intervals, break through fences, and tear and trample down the canes. These ravages would be very serious, were the plant itself *less* hardy, but fortunately this injury it quickly recovers from, and shoots up again with astonishing rapidity.

This cane was introduced into the West India Islands much about the same time as the Bourbon, and is still much cultivated there. It is, like the yellow violet, generally mixed with Bourbon plants.

The Transparent, or Ribbon Cane, is of a transparent bright yellow, with a number of blood red streaks, varying in breadth from a quater to a full inch, and being very clear withal in its tints, it presents a very pretty appearance. Its leaves are of a green like that of the yellow violet, but far more erect. Its joints are from six to eight inches long, four in circumference, and six to seven feet in height.

In Jamaica, the transparent is generally planted in light sandy soils, where no other cane will thrive; sometimes it is planted promiscuously with the yellow violet.

Although its rind is thick, and general texture hard, yet it yields a good quantity of juice of excellent quality, which is easily converted into fine fair sugar.

The transparent is also mixed with the Bourbon. These three descriptions of cane I consider are admirably adapted to the East Indies, more especially the first and last varieties.

The Native Canes I cannot attempt a description of, as I have not yet had sufficient experience of their relative qualities; however, it may not be out of place *here* to state, that

every planter I have met with in this district, gives the preference to the superior descriptions of Native cane, considering it a *far safer*, if not *such* an *abundant* crop.

The CHINESE CANE was supplied me from the Society's Garden, Calcutta, and took upwards of two months coming up by boat, yet was perfectly fresh and green on its arrival, whilst the other descriptions had all withered away and died. From the 300 sent to me, I have this season obtained sufficient cuttings, to enable me to plant out about six begahs, besides supplying my neighbours with a few. In its nature it is extremely hardy, and very prolific. During the last hot season it remained uninjured in every respect, whilst the other canes were *all* either burnt, or eaten out of the ground by white ants. As the rains came on, they sprung up wonderfully, many roots having no less than thirty shoots, which by September had become fine canes, about twelve feet in height, three inches in circumference, and with joints from six to eight inches long. These were cut in October and planted out, yet although we have had a tolerably severe winter, the cold appeared to have little or no effect in checking their growth, but Native canes planted at the same time were entirely kept back. I have not seen sugar made from these canes, but Dr. Wallich informed me, that they are much valued by the Chinese, for sugar-candy manufacture. For their extreme hardiness in withstanding heat or cold, white ants, jackals, &c. I myself can vouch, and consider it a variety of cane which deserves every attention.

(To be continued.)

Memorandum regarding an Oil-producing Seed, in the District of Bolundshahur. By Mr. THOMAS TONNOCHY, *Deputy Collector.*

I have found out a drying oil seed, produced by a weed which grows spontaneously in this part of the country.' I sent a sample of the oil to my agents, and its quality was in the first instance tested at the Calcutta Mint, through Major Forbes; it was then pronounced equal to English Linseed Oil, except in point of gloss, which the latter was said to produce in a higher degree, but which defect it was thought would be obviated by giving the former a further boiling. The difference, however, comes to nothing, for the oil I sent was wholly unboiled, and the trials I gave it here, shewed it not to be wanting in conferring a very high degree of gloss to paint. The oil has secondly been tried in England, and the following copy* of the report of its quality will serve to shew, that if not superior to English Linseed Oil, it is at least considered not inferior to it. I, however, think it far more valuable, and it will I trust prove so on further extended trials; it apparently possesses greater fluidity, and does not, like Linseed oil, turn thick and ropy by age; and as it hardly emits any smoke when burning for light, and forms no head, it must be taken to be far more pure from extraneous matter than Linseed Oil. I consider myself fortunate in bringing to light a new and important article of produce; that article if I mistake not, being the only other, besides Linseed Oil, which possesses within itself, or rather I should say, the intrinsic quality, of drying. I have lately made a large dispatch of the oil to Calcutta, and have also sent with it two bags of the seed, both husked and unhusked.

* Messrs. R. Wilson and Co. beg to inform Messrs. Lyall, Brothers and Co., that they have had the qualities of eleven bottles of oil marked L. B. and Co. ex-Scotia, tested by two competent persons, both of whom agree, that it is a drying oil of *a superior description*, yet, not more valuable than Linseed Oil, as it could only be used for that purpose. Indeed, eight bottles out of the eleven were of a yellowish color, exactly like Linseed Oil, and if R. W. and Co. had been asked, what oil it was, they would have pronounced it Linseed Oil. The other three bottles are of a greenish color, having something of the appearance of bleached or refined Linseed Oil.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. III.—1843.—Vol. II.

On the causes which have led to the failure of the Cotton crops in the Government Experimental Cotton Farms in the Doab, during the season of 1842, *with suggestions for conducting further operations in the culture of Cotton, and for Agricultural improvement in general.* *By Mr.* T. J. Finnie, *American Planter.*

In compliance with your request, I will now attempt to continue an account of the cotton experiment; if such a rough note as I have only time to write, will afford you and the friends of *internal improvement* in India any satisfaction, it is very much at your service.

It may be recollected, that when I closed my letter on the 27th of July to your late lamented Secretary, nothing was so desirable as fair weather, which had then commenced, as the excessive rain had greatly interfered with our work; but the reverse was soon the case, for a tropical sun shone forth in all its fierceness, accompanied by a strong westerly breeze, which in a few days became as

hot as any which raged before the commencement of the rains, and so much heat acting upon the excessively wet ground, rendered it so hard, that it was impervious to the hoe or plough before we could get half the crop ploughed and hoed once, and consequently vegetation, which had sprung up vigorously, was suddenly checked, and all agricultural operations were suspended, or prosecuted to great disadvantage. We however continued to do all in our power, though at much greater cost than would have been necessary had the ground continued moist, to save the crop until rain should fall, and render our labours productive; but, alas! it came not until the plant was irrecoverably ruined; until it was literally burned up by that all-absorbing, unsatiable monster and curse to this country—hot winds, which evaporates every particle of moisture in the earth and atmosphere, and causes such excessive perspiration in the plant for so long a time, that it becomes weakened and sickly. In such an atmosphere as this, the leaves cannot perform the functions nature has assigned them. The cotton plant derives much of its nourishment *from the atmosphere through the leaf*, and if the food placed in immediate contact with the feeders of a plant be unfit for it, the plant having no power to resist, perishes of course. The effects of the hot wind soon reach the seat of vitality of vegetable existence, the root, and deprive it of the nourishment it receives from that source also. With all these evils to contend with, we have in vain lavished pains, care, and attention upon the American cotton plant; but a defect in *climate* cannot be rectified by the application of scientific, or practical rules, and the *delicate exotic* fails to produce well in this climate in spite of our care; and I am sorry to inform you, that the hopes I entertained when there was a prospect of a favorable season, of a success equal to the most sanguine expectations of the most enthusiastic advocates of the enterprise, have not been realized, not from any fault or want of zeal in those immediately

engaged in the operations, nor from any fault of the system of cultivation we have attempted to introduce, but a failure, a lamentable failure has been brought about, *solely* from the want of that which in this country may be truly called a *precious element*, "*a jewel of great price*," *water*. The want of humidity in the earth and atmosphere for so long a time, when the plant most requires nourishment, has led to the bankrupting of our *hopes*. Aye! and our *purses* too, as far as success in this part of the country is concerned.

You will recollect, that the rain ceased on the 24th of July. Soon afterwards, the hot winds began to blow, and increased in strength and heat daily, and, as before stated, every particle of moisture in the earth and atmosphere disappeared, and there was not even a drop of dew to be seen or felt morning or night, and thus it continued till the 5th of September, when we had a slight shower of rain, but so slight, that no traces of it were perceptible a few hours afterwards, and the hot winds having been pent up for a time, broke forth with increased strength after the clouds had passed over. On the evening of the 8th and morning of the 9th of September, we had a fine genial shower, but in consequence of the excessive heat, it did little or no good. On the evening of the 14th, the rain commenced falling, and continued until the morning of the 15th; this was a fine rain, and I hoped it would instil renewed vigour into the hitherto poor diminutive famished cotton plant, but alas, it came too late, for if the steam of a high pressure engine had been let loose upon them, it could not more effectually have deprived the few remaining leaves of the power of performing their functions, than did the steam that issued from the over-heated ground when water was poured upon it; it was slower in its effects, but not less certain. The atmosphere continued hot, and I had the mortification of seeing the great staple plant look worse every day. All the forms, flowers, and even young bolls which had clung to their parent until they had obtained the size of pigeon's eggs fell

off, and the ground was literally covered with them, and the plant burned to a cinder; the prospect to me was really a dreary and heart-rending one.

A heavy rain which fell on the 5th of October, and continued till the 6th, cooled the air, and we had pleasant cool nights and heavy dews, the first I ever saw in India, which occasioned a decided improvement in the cotton, and it put out new leaves, forms, and flowers; but the season was too far advanced then to gain any great benefit from a little temporary humidity. As early as August, when the drought was so severe, I despaired of working the American cotton in *remunerating quantities, or desirable qualities,* for it requires a more humid climate than this part of the country is blessed with, to do either. When I was told by those, who ought to have known better, that 1841 was an *unfavorable* season, such as we would not encounter again for ten years perhaps, and judging from what was done under all the disadvantages we had to encounter, besides the season, I asserted that in a *good season* we could make cotton in abundance, and this opinion I maintain now as strong as ever; but after two years' experience and hard labour, I am not dependent on the opinions of others respecting the seasons, and finding that *bad, decided bad* seasons greatly predominate, I now assert positively, that the American cotton never can be produced profitably in this *uncertain, certainly dry, uncertainly wet climate.* That cultivation improves the producing powers, and draws out the latent capabilities of the indigenous plant is proved beyond a doubt. This year I planted about 320 English acres of the American cotton, and eighty or ninety of the native plant. And Mr. Terry, who had the management of the plantation during my absence, tells me, that he has gathered more cottons from the eighty or ninety acres of indigenous plant than he has from the 320 acres of American; the result has been the same on Messrs. Terry's, Blount's, and Mercer's plantations in Bundlekund. This proves the advantage of cultivation, and the

greater ability of the native plant to endure drought; but do not understand me to give a preference to the native plant over the American plant, if the climate suited better. The American plant is much more prolific than the native, but the native produces more here.

My native cotton was planted in rows, four feet apart, the branches meeting in the middle, and the plant grew to the height of from seven to eight feet, and has produced so well, to the great admiration of the people, that they say, "if they could make such crops for a few years, they would fight the Company." I endeavoured to explain to them that they could, if they used such means as I did, but they said they had not the "*hickmuth.*" Mr. Terry's native cotton is far better than mine, the land being richer. This ought to be proof positive that the system of cultivation is not defective. I regret that I cannot give you the exact amount of produce, or precise quantity of land, but will, when it can be arrived at.

I must not forget to mention, that the little American cotton we have produced at great expence is of very inferior quality, it being excessively weak, as you will see from the accompanying parcel, which must be attributed to the want of rain to give it stability. The result of the native plant this year proves, that the natives themselves will derive great advantages by the adoption of a better system of cultivation, which is to be hoped; and I think they will, when they become familiar with me. The plough costs a little more in the first place, and it requires a better *team* to draw it than would answer for their miserable instrument; but if they have an idea of the *economy of time*, they would see at once, that while they were ploughing and *reploughing* one acre with their own plough, they might with the same work have thoroughly turned eight or ten acres with the plough we use; but in this case we have old established customs to contend against; the people do appreciate our mode of ploughing and cultivating, and some are anxious to have our ploughs, but cannot

afford to give what they cost in England, and I think the *establishment of plough manufactories* in different parts *of the country would do* much good in familiarizing these people with them, and to supply them at a cheap rate. I believe that if the people of this country would adopt our plan of cultivating many of their products, and use our plough always in breaking up land, they would be greatly benefited by it, and could produce *the native cotton much more abundantly* than they can possibly do in their own; *that is, let* them apply their *cheap labour* and *cheap mode* of living to *our superior mode* of performing the work, and they would become richer, and their latent enterprize and industry stimulated, and great good would result from it. I think whatever is done in improvement, to be permanent, must and ought to be brought about by directing the energies of the people in the proper channel. The common people are mere children in our hands; by *kindness* and the occasional exercise of a little *affectionate authority*, they can be induced to do any thing. There are two great fundamental principles that must be brought practically before the people, before India can rise from her present moral and pecuniary degradations; viz. intersect the arid part of the country with canals, and familiarize the agricultural people with a *better system of agriculture*. Do this, and India will rise high among the *producing* nations of the earth. Do this, and you spring a mine of inexhaustible *wealth*; but this cannot be brought about in a year or two, but must be done by the adoption of *judicious* and energetic measures, diligently persevered in for a length of time before any good can result from our efforts here. In neither of the above branches of *internal improvement*; viz. canal-making and agriculture, can Government expect an immediate return of their capital. The object of Government ought to be, and is I hope, to benefit the people of this country, and by encouraging their industry in the production of the *staple* articles of tropical climates, will materially benefit

the world at large. If any thing could strengthen the affections of the people for the British Government, carrying water to their doors, and placing them in possession of the means of obtaining a more abundant supply of the necessaries of life, and a larger return for their labor, will, more than any other measure, tend to the accomplishment of so desirable an union of interest and feelings, as ought always to exist *between the governors and the governed. But while all these improvements are taking place, let us avail ourselves of the good things with which we are already blessed.*

I have taken a long tour through the North-west Provinces, and have observed particularly, the capabilities of the country even under native management, for the production of the common native cotton, which is acknowledged to be a very useful and acceptable article to the English manufacturers, if it could be had in a *marketable condition.* Then if it be an object to supply the English market with cotton from India, let Government and our private capitalists establish Gin-houses in almost every thickly inhabited part of India, and contract with the people for cotton according to its *cleanliness and quality,* to be delivered at the Gin-house in the seed, and I doubt not any quantity could be procured of a quality peculiar to the country and climate in which the Gin-houses are situated. Create a sure market for their produce at their doors, and the people of India will soon avail themselves of it, and but a few years will elapse before the good effects of the measure will be perceptible in the market. In connection with the Gin-house, there might be a small model plantation to prove to the people, that by cultivation, much more will be produced than without it, and a plough manufactory would advance the cause much ; for it is evident, that no benefit can result from placing a better mode of cultivation before them, unless you at the same time place the means of adopting it in their power, by supplying them with ploughs, etc. at a cheap rate.

Notwithstanding the unfortunate result attending our efforts here, we do not despair of ultimate success, in countries where the causes which led to failure here do not exist, and I am sure India possesses territory equal to the whole cotton-growing region of America, *in which it will succeed admirably*, and when I see the Governor General, and all in authority, manifesting the greatest possible interest in the matter, we are encouraged to continue our shoulders at the wheel, and do all we can to advance the objects for which we came here.

This letter is I fear already much too long for your Journal, but before closing, I must give you some account of the to-be-movements in the "cotton department." We are scattered to the four winds; Mr. Mercer has gone to Bombay, Mr. Blount is off for Gorruckpore, and Mr. Terry remains to superintend the ginning and packing of the cotton, and to gather the grain and wheat crops in all the plantations. After which, he will attempt to make a crop in one of the places, as it would be too late for him to move this year. It would be folly to attempt to keep up all the plantations with the poor assistants this country supplies. I go to Agra, not with a hope of doing much in the Agricultural way, for it is, if possible, drier than this part of the country; but I hope to convince some of the wealthy natives, that by the establishment of Gin-houses upon the plan mentioned, they might realize a large profit, and if possible, to induce them to take up the matter. The wealthy and intelligent natives about Agra are much more capable of appreciating any thing of that kind, than the people in the neighbourhood where I have been. If we can ever get the people to take up the matter, it will then get on well. I think there is a want of confidence among the Europeans, the head of the Government, and others in authority, in our plan of operations, which must be removed by bringing the matter more before them. We have been in the jungles, where we scarcely ever saw or knew any thing about what we

were at. I hope now Lord Ellenborough himself will see, that the system of cultivation and ginning is worth extending all over the country. We will have a gin erected at Agra, one at Hummeerpore, one at Gorruckpore, one at Mirzapore, *and one at Saugor;* at the two latter places there is no one who knows how to set them up, or to regulate the draft to* separate the trash, motes, &c. from the cotton. I think Malwa, Saugor, Berar, &c. and that part of India, well suited for the growth of cotton.

Mr. Mercer writes from Omrawuttee, that the people are nearer right in their mode of cultivation than in any other place he has seen in India, and the cotton there is good, and only wants care in cleaning it, to make it a very desirable article. To Gorruckpore, Bengal, Assam, Tennasserim, &c., we must turn our attention for good cotton in that quarter; and as we are not disposed to leave all the Upper Provinces destitute until the canal is completed, we must endeavor to clear out the Terai at the foot of the hills, and to get into the Doon. I saw as good cotton from the American seed growing in the Doon, as is usually produced in Mississippi and Louisiana. I send you a lock to compare with that produced in the plains; it was produced without care, and is some of the last bolls from the shrub. The native cotton produced in the Doon, and also in the Terai, is of a very superior quality. I see so much that might be done, and ought to be done, for the improvement of the Agricultural resources of India, that I am scarcely able to decide what ought to be done first, or where to commence operations. We feel that we are surrounded by a dense jungle as it were, upon which our personal efforts can make but little impression.

* In a later communication Mr. Finnie mentions, that the Governor General has directed this suggestion to be carried into effect.

Further particulars regarding the Berareea Cotton. Communicated by H. Hamilton Bell, Esq.

Omeghur near Agra, 15th February, 1813.

The details given by Major Sleeman, in the November number of the Agricultural Society's Journal, respecting the cotton from which the Chundehree cloth is manufactured, so closely correspond with information I had collected, and was about to submit to your late Secretary, when I heard of the melancholy accident which deprived the Society of his valuable services, that it seems undesirable to do more than advert to one or two points he has left unnoticed, in transmitting you musters of the cotton, which I infer he did not, as he only alludes to one of thread spun at Chundehree.*

The price of the Berareea *imported* cotton in the Chundehree bazar may be taken, on the average, as my informant says, at six seers per rupee in the state of *kuppas,* and, as he gives the same proportion of nett cotton as Major Sleeman, this makes the clean cotton cost equal to about forty rupees per maund.

The seed of the Berareea cotton, said to be sown only in a few fields of the two villages named by Major Sleeman, produces there a cotton of a better colour, but considered of inferior quality, and is there termed Berareea *desee,* selling at about twenty per cent. lower price. The soil is supposed materially to influence the quality of the cotton; but in the two villages this is evidently most dissimilar, that of the one being described to me as of a *light reddish,* and of the other, a *very black colour.*

My opinion has always been, that we should look to the extension of the cultivation of the best indigenous cotton, instead of giving our sole attention to the introduction of foreign seed, and under this view I sent an Agent on whom I could depend, to Chundehree, to purchase some *kuppas,* to be quite sure of the seed being unmixed. I caused the *kuppas* to be cleaned

under my own inspection, and the seed separated to be sown in the best lands in some of *my* neighbouring villages. The drought destroyed the whole, excepting in one field close to my bungalow, and this suffered greatly from white ants, so that I can give you no estimate of produce per begah; for although scattered over five begahs, the whole of the plants could have been crowded in one. The plant has generally reached the height of six or seven feet, and bears more profusely than any I have ever seen. On one plant, that had been repeatedly *picked previously, I caused the remaining pods to be counted, and there then remained 187* pods. These were not large, and probably might have been the better for thinning, and the proportion of seed to cotton is considerably greater than from the common cotton of these districts. It is possible the scanty rains of the season may have contributed to this.

It may be worth noticing that there are certainly *three,* and I suspect *five* descriptions of cotton in the field, all sprung from seed extracted from the same parcel of *kuppas*. The shape of the leaf, of the plants, and the flower all differ, and they certainly cannot be identical. I cannot myself perceive any difference in the quality of the cotton, nor could Mr. Finnie, to whom I shewed them, and who was much struck with the cotton generally. I suspect we have not hit on the best mode of cultivation; for I am disposed to think the seed should be sown at least a month before the rains, and brought forward by irrigation.

I send you musters of the cotton yielded by the three descriptions of plant I assume to exist in the field, and from them you will be able to judge if the quality is materially, or at all, inferior to the real Berareea accompanying. This might be anticipated from the restricted cultivation asserted; but although Major Sleeman and my informant both agreed as to its being confined to two villages, all these reports must be taken "*cum grano salis,*"—at all events, the cotton is superior to that generally produced in India.

I do not trouble you with a muster of the yarn, as that I have procured is evidently the same quality as Major Sleeman's, the price and length of the hank being the same. Finer is certainly spun, for my messenger said that, after he had bought the sample he brought me, he saw some selling at eighty *peshuk*, or *hanks*, for twenty rupees, or four instead of five *hanks* per rupee, and he added, that he heard they make finer, but to what degree he could not tell. The weavers are of various Hindoo castes, and also Musselmen.

I have heard of some extraordinarily fine cotton produced in a village in Oude, and I have sent a messenger there to buy for me a small quantity of the *kuppas*. If it prove as reported, I will send you a muster, and an account of the result of my cultivation of it.

The Sugar Planter's Companion.

By L. Wray, Goruckpore.

[Continued from page 51.]

On the Influence of Soil, Climate, and Seasons.

It must be very apparent to every one, the great influence which particular soils, climate, and seasons, exercise on the growth and developement, of so sensitive a plant as the sugar cane, and it necessarily follows, that some slight knowledge of the *nature* of such influences is required in those who hope to arrive at any thing like perfection in its mode of culture. A knowledge of the causes by which our plants are affected, will put us in possession of such power as will enable us to overcome, in a great measure, those evils which threaten them, or by foreseeing danger, so to direct its course, as to lead to results of a pleasing character.

In the first place, therefore, we must form an acquaintance with the nature of *soils*, to which end I shall select and introduce the opinions of scientific writers, on the subject, as I proceed.

In addition to carbonic acid, water, and ammonia, (which are indispensable to vegetable life,) the cane plant requires other substances to aid in the formation of particular organs, destined to perform those functions peculiar to the plant itself, in common with plants of the same tribe; viz. *Gramineæ* and also the *Equisetaceæ*, or reed canes; it requires silicic acid and potash in the state of silicate of potash, in order to form its solid frame work or stalk, and even the outer parts of its leaves, &c. Other constituents which different soils may furnish, are made use of by the cane in the elaboration of its juices, the greater or less abundance of which friendly auxiliaries, would consequently cause a *material* difference in the produce obtained, both as regards quality and quantity.

Porter, treating of the soils suitable for canes, remarks, " a mixture of clay and sand, or what has been called brick-mould, seems to be generally acknowledged, as most favourable to the growth of the cane, and although the effects of rain on this soil are apparently soon over, its surface quickly drying, the inner portion contains a considerable quantity of moisture, even in the driest weather, and it has the advantage of seldom requiring trenches to be made even in the wettest season."

This is more particularly the case, where the clay predominates, and is rich in certain mineral oxides, whilst the sand in combination is of the silicious kind.

The power of aluminous earths in attracting and retaining water and ammonia, is shewn by Liebig to be the cause of that great influence which they exercise on the life and development of plants, water and ammonia being, as we have shewn, the life and soul of vegetable creation; we can readi-

ly conceive the fertility which results from their abounding in connexion with those constituents of the soil, so peculiarly favourable to the growth of the cane.

On this point Liebig is particularly interesting, whilst he clearly explains "*a fact,*" hitherto considered so incomprehensible. He tells us, that "the oxides of iron and alumina are distinguished from all other metallic oxides, by their power of forming solid compounds with ammonia. The precipitates obtained by the addition of ammonia to the salts of alumina or iron, are *true* salts, in which the ammonia is contained as a base. Minerals containing alumina, or oxide of iron, also possess in an eminent degree the power of attracting ammonia from the atmosphere, and retaining it."

Vauquelin, whilst engaged in the trial of a criminal case, discovered that all rust of iron, contains a certain quantity of ammonia.

Chevalier afterwards found, that ammonia is a constituent of all minerals containing iron.

"Soils therefore, which contain oxides of iron and burned clay must absorb ammonia, an action that is favoured by their porous condition; they further prevent the escape of the ammonia once absorbed by their chemical properties. Such soils, in fact, act precisely as a mineral acid would do if extensively spread over their surface; with this difference, that the acid would penetrate the ground, enter into combination with lime, alumina and other bases, and thus lose in a few hours its property of absorbing ammonia from the atmosphere. The ammonia absorbed by the clay or ferruginous oxides, is separated by every shower of rain, and conveyed in solution to the soil."

In the West Indies, a variety of other soils exist, which are excellently adapted to the growth of the cane; whilst in the

East, a good strong soil, retentive of moisture, and free from white ants is to be chosen; a judicious application of manure will keep up the requisite degree of fertility, and repay a hundred-fold the expense attendant. This point is too often neglected, the soil is unassisted, poor crops are the necessary consequence, and thus a vast proportion of produce is lost, which might with care have been secured.

The *climate* most congenial to the sugar cane plant is of a hot and moist nature, attempered by the sea breezes.

It has always been found to thrive most luxuriantly on Islands and on the sea coasts, which serves to convince us, that the saline particles borne on the sea breezes exercise a wonderfully beneficial effect on this plant. This influence is exerted in two ways; viz. by affecting the soil in which it grows, and also by affording matter for assimilation to the leaves. To explain this, it becomes necessary to shew the manner in which the cane receives nourishment from the atmosphere, and by the aids of solar light and heat, converts it to the purposes of developing its various organs, and perfecting its juices.

The *leaves* of the cane, in common with every other plant, are endowed with the power of absorbing nutriment from the atmosphere, and when each leaf has become perfect, its collections are still continued, and prepared for the benefit of the parent stalk, &c. Dr. Liebig simplifies, in his own peculiar style, this beautiful and interesting process of nature.

"We know," he says, "that the functions of leaves and other green parts of plants, are to absorb carbonic acid, and with the aid of light and moisture, to appropriate its carbon. These operations are continually in operation; they commence with the first formation of the leaves, and do not cease with their perfect developement. But the new products arising from the continued assimilation, are no longer employed by the perfect leaves in their own increase, they serve for

the formation of woody fibre, and all the solid matters of a similar composition. The *leaves now* produce sugar, amylin, or starch, and acids, which were previously formed by the roots, when they were necessary for the developement of the stem, buds, leaves, &c. of the plant.

"The organs of assimilation at this period of their life receive more nourishment from the atmosphere, than they employ in their own sustenance, and when the formation of the woody substance has advanced to a certain extent, the expenditure of the nutriment, the supply of which still remains the same, takes a new direction, and blossoms are produced.

"The functions of the leaves of most plants cease upon the ripening of their fruit, beca se the products of their action are no longer needed,—they now yield to the chemical influence of the air, generally suffer then from a change of colour, and fall off."

The leaves of plants have ofter been likened to the organs of respiration in animals. During the day, when exposed to the action of light and heat, they absorb carbonic acid and exhale oxygen, but during the night this is reversed, for they expire carbon and inhale oxygen. These operations are materially influenced by the intensity of light and heat, and by their greater or less continuance peculiar to the climate. Maunder in his "Scientific and Literary Treasury," treating of the effects produced by light on vegetables, states that

"They are not only indebted to the light for their *colour*, but taste and odour are likewise derived from the same source. It, moreover, contributes greatly to the maturity of fruits. This seems to be the cause why, in tropical climates, fruits and vegetables are in general more odoriferous, of a stronger flavour, and abound more with aromatic resins."

In the sugar cane this is particularly apparent, for deprived of the strong light and heat of the tropics, it dwindles

away, and, by the great preponderance of aqueous juice, becomes of little value. It is from the powerful effects of the sun's rays, together with the relative proportion of carbonic acid and oxygen, which it inhales and exhales, that the transformation of its juices is brought to perfection, and the saccharine matter becomes secreted in generous abundance.

In a level country, no obstacle exists to the action of light and heat, but in hilly or undulating lands the case differs much; the variation within a small circle may be, and often is, very great.

The *Seasons* are divided into the cold, hot, and rainy, each producing its particular effect on the cane plant.

Of this district, (Goruckpore,) I can speak from experience. Here the native cane will not vegetate, if planted in the cold season, until the return of warm weather, whilst plants of a couple of months' growth are completely stinted, and become like so many tufts of grass, which as the season grows warmer, begin to send out numerous vigorous shoots. These in their turn, have to contend with the dry weather and scorching hot winds, become burnt up, and are only saved by the commencement of the rains. Truly wonderful is it then, to see the rapidity of their growth; in three months only fine fields of tall canes appear, where previously all was dry and parched. It is at this period that trashing* should commence, and be continued at intervals, as may be required; for it is natural to suppose, that the juice of canes shooting up so suddenly in the midst of the rains, must be altogether aqueous and tasteless, if allowed to retain the leaves which envelope them, and hinder the penetration of light and circulation of air.

The rainy season, is a season of refreshment and renovation to the soil, which dried up and exhausted, yet no soon-

* Stripping off the superfluous leaves.

er receives its welcome showers, than it is all greenness and beauty.

The rain which falls imparts fertility, by the quantities of ammonia which it supplies to the soil, and which are fixed therein by particular constituents of the soil, as have been before treated of.* Dr. Liebig gives us the quantity of ammonia contained in rain water obtained in *Europe*, but I think I may venture to express it as my opinion, that the proportion is much greater in *India*.

It is a fact, justified by careful observation, and the concurrent testimony of the native cultivators, that the more often lands are ploughed and worked up during the rains, the more productive do they become, which *must* arise from atmospheric influence.

Mode of Culture—comprising Ploughing, Planting, Moulding, Weeding, Trashing, &c. &c.

In the cultivation of the cane, the first stage which we arrive at, is the preparation of the lands destined for its reception. In India this is very simple, in as much as such lands are generally Zemindaree, and have long been in cultivation; under that supposition I will therefore treat of them. In the early part of June, on the first symptoms of rain, begin carting out your manure as expeditiously as possible, strew it lightly over the land, and have your ploughs in readiness for work. On the first fall of rain, set them to plough up those fields already manured, giving each two "*chasses*;" (viz. one from East to West, and the second from North to South,) as you proceed, until the *whole* is gone through. Then commence again, using the "*hanger*,†" where you see necessity, and continue working up the soil until it is required for planting.

* See page 66. † A native harrow.

The plough which I would recommend for this work is the small plough, shewn in sketch as No. 1. This implement was given me by "*The Society*," under the name of an "American Cotton Plough," which, finding imperfect, I altered by degrees, until I brought it to its present improved state.

As I have used this plough in ploughing and trenching some few hundreds of begahs of land for cane, I can safely answer for its efficiency and utility; however, as the advantages to be derived from its use are known to but few, I will take a brief review of the relative merits of *this* and the native plough. It requires one man and a boy, and two cattle. The man puts it on his shoulder and walks off with it to the field in the morning, the boy follows with the cattle, they work from 5 to 9 o'clock A. M., the bullocks are then brought home, and receive one seer, each, of gram, rest until 3½ P. M., when they again set to and work as long as the light lasts, averaging two begahs as a day's work.

The expence of this work is therefore as follows; viz. wages of man and boy three annas, gram two annas, bullocks &c. four annas, making a total of nine annas. In case a native plough precedes the American,* even then the additional expence of four annas only increases the amount to thirteen annas. No person, whether European or Native, who has seen the work performed by these ploughs, will for an instant hesitate in saying, that *one* "*chass*" with them, is more than equal to *twenty* "*chasses*" of the native instrument; such then is the improved American plough.

With the common *Native* plough, you can have four *chasses* to the begah, (*tekah* work,) for one rupee; but the careless manner in which it is executed, when combined with the

* I generally have a native plough to precede the other, as the cattle in the American plough will then follow willingly and straight, from habit.

mere *scratching* which the land can at best obtain from it, renders it undesirable and unsuitable for cane cultivation. *However, necessity will in many cases insure its being employed, for some length of time yet to come, even by European* sugar planters.

Cane lands require to be well turned up, and if your ploughs can penetrate even to a foot or more in depth, so much the better, as so much the more fertile will your lands become. Such a desirable object can, however, only be hoped for, when the cultivation is entirely *Neez*, for the Ryots would by no means use their own cattle in the American ploughs. The only plan therefore would be to provide your cultivators with a *proper description* of *native* plough, which I have no doubt can be so improved on, as to answer very tolerably. I am at present engaged in an attempt to compass this desirable end, and should I be successful, I will not fail to notice it in a subsequent number of this Journal.

I would wish it to be observed, that the mould board on the plough No. 1, can always be arranged at the discretion of the Planter himself, who can widen or make it more narrow, to suit the work he requires performed.

The advantages of ploughing the manure into the soil during the early part of the rains are quite obvious; if it be fresh or recent, ample time is afforded it to rot completely, and become incorporated with the earth, before the cane is planted; but if rich old manure, its constituent parts are rendered soluble by the frequent showers, and are then easy of assimilation.

Leaving spaces for roads and intervals, alone remains to be noticed under this head. In doing so, great attention must be paid, that they all run as directly as possible to the works. Of course these spaces will not be ploughed with the rest of the lands, but allowed to remain hard until the rains cease, when they can be dressed.

The preparation of village lands* should not exceed three rupees the pucka begah, unless they are treated with manure, in which case, one rupee, or perhaps one rupee and *eight annas may be added. This latter may be considered by far too low a charge, but in reality it is not so*, as will be shewn, when we come to the chapter on Manures.

The preparation of the land being thus far advanced, and the rains breaking up, the ploughs No. 1 and No. 2 must be put into requisition, for the purpose of trenching the land for the reception of the cane.

To expedite matters, twenty or thirty sets of these ploughs may be employed at once, whereby (in an estate of 500 begahs,) the whole of your cultivation could be planted out in the space of ten or fifteen days.

But if it be not intended to plant canes immediately after the rains, the prepared lands are either allowed to lie fallow, or the Assamees are permitted to take off a barley crop, (under certain agreements.) In either case the land is ready for cane by the middle of March, and all planted out by the middle of April.

It may, and does often happen, that the Planter is to enter into possession of lands, immediately after the rubbee crop is reaped, in which case, it is his interest to plant them out at once, otherwise he will lose a season. Here, then, he must give what amount of preparation his *time* will admit of,† *without* attempting to apply manure, the commencement of the rains being the signal for *that* operation.

Or, should lands be obtained in January, so much the better, as more time is allowed for preparing the soil, and they can be planted in cane, whilst the moisture is yet re-

* All these observations, etc. are meant to apply more particularly to Goruckpore, and the surrounding districts.

† In preparing your land during the hot weather, endeavour to perform your work during the night, and not in the heat of the day. This can easily be managed.

maining, say, during all February and the early part of March.

"*Planting*" *Canes* must be divided into, and treated of, under two heads; viz. the proper time, and the most advantageous method of doing so.

The time most suitable may vary much according to the peculiarities of soil, climate, and seasons, characteristic of the locality fixed on, or still more perhaps from the particular nature of the description of cane to be planted; I will therefore run through the year, taking a brief view of the good and bad, attendant on planting at the several periods, leaving it to the Planter to determine which will best suit his circumstances.

January in this district, is too cold for the native cane, but in the event of a shower or two, the Otaheite and Chinese varieties, may with great propriety be planted. *They* vegetate in spite of the cold, and February's genial warmth conduces to their rapid and vigorous growth. They attain a tolerable height and good root by the time the hot wind sets in, and are consequently better able to stand its effects. They will perhaps require irrigation in March, April, May, and June, in all, four times. The extra month or two they remain in the ground, may be considered as the chief objection against this month (for the varieties named) as affording a greater length of time for the ravages of the white ants.

February and March are the months in greatest repute *with the natives* for planting, and very justly so. They calculate on three irrigations and twelve *ghorie-ings*, by which term they include loosening the soil, moulding the plants, and freeing the field of weeds, during the progress of the cane towards maturity. However, they do not by any means consider

April a bad month for planting; on the contrary, they prefer it, when sufficiently temperate, as they can thereby

save one or more irrigation, and at the same time, the plant is exposed to the white ants during one month less. This is *now* the latter end of April, and I can at this moment see* a number of Ryots planting canes in the neighbouring fields, not 200 yards distant from me.

May is a very hot dry month in these districts, and it does not consist with my knowledge, that cane is ever planted by any one during it.

June in its early part is also very dry and hot, nor can I remember having seen any planted in this month either; nevertheless, I am inclined to consider it as very possibly the best month in the year for planting, and I am led to form this opinion from a variety of circumstances. Amongst the many, I will only state that *two* irrigations only are necessary; viz. at the time of planting, and some weeks afterwards, which will amply suffice, till the commencement of the rains. The long dry weather, during which the plants would be exposed to the mercy of the white ants, is entirely avoided, the canes could be *cut* in December, and thin rattoons in the early part of the following November.

July.—Canes can be planted in this month to advantage (if necessity be,) provided always that the lands are not really too much drenched with rain. This liability is indeed the only reason to be urged against it as a planting month.

August is as the foregoing, only perhaps more wet.

September is usually the "breaking up" month, although it very often I believe proves wet and rainy throughout. When such is not the case, however, I would most decidedly recommend it as a planting month, in situations where white ants do not abound. This and the following month differ very little in the canes they produce, which are generally characterised as sufficiently vigorous and forward to require but one watering during the whole of the dry weather. True, they may look parched and dried up, but the

* In Ghazeepore.

first fall of rain in June revives, and calls them again into life and luxurious vegetation. *White ants* are much to be feared by cane planters sowing in this month, and nothing else.

October.—The rains have ceased, and canes may be planted to great advantage, subject only to the dread of white ants, as stated for September.

November and December.—I would strongly advise no sowing of cane in these months. It is better to wait for February, as before shewn.

The Planter is undoubtedly oft-times obliged to plant when he would wish to postpone doing so, until a more opportune season should present itself. Again, he might wish to plant all his lands out, at a particular time, when circumstances or expediency may deter him. It is right therefore to weigh well the chances each particular period affords, that you may never be at a loss in deciding, even were the question to come on you *ever* so abruptly.

The months of March, April and June, I consider as the most desirable for planting of any, not only on the score of white ants and irrigation, which of themselves are most important; but also for the saving in the number of *ghorie-ings*, in cultivation-chokedars, in depredations by stray cattle, and a variety of other animals, in *trouble, anxiety and superintendence.* In short, it is seven or eight months' attention, risk etc., instead of ten, eleven or twelve. September, October, and February have also their particular advantages; the two former shewing fine, tall, vigorous plants, before the hot weather sets in, and requiring little irrigation during its continuance; the latter also producing a very forward plant, which will require perhaps four waterings to help it over the dry months.

In situations, where the soil is sufficiently retentive of moisture to be capable of supporting vegetation, without the *necessity* of irrigation, a number of these distinctions are of course not applicable.

Before entering on the subject of planting canes to the best advantage, I will first notice the cultivation usually denominated "*Assameèwar,*" or Ryottee, by which is understood, cultivation by contract with the Assamees, or Ryots. This varies to some extent, where the lands so cultivated are the planter's own property, and supplied the Assamees free of charge. In either case, however, the planter provides his cultivators cane for planting, and makes advances from time to time in money, as the circumstances of his agreements may chance to be.

Two or three days since,* I entered a field which had been just planted out in cane by a native, and seeing the proprietor and others there, I was induced to enquire into the actual expenditure requisite to bring it, (one pucka begah,) to a state of maturity, &c. Their replies were most satisfactorily clear and concise. They said, "Sahib, this field of cane will be fit to cut during November and December, in the mean time it will require two irrigations at one rupee and eight annas, equal to three rupees; and twelve *ghorie-ings* at six annas, equal to four rupees and a half. It has already cost us four rupees for preparing and planting, besides which, we are made to pay five rupees as rent; altogether, the begah of cane costs us sixteen rupees and eight annas. If the crop turns out good, we shall obtain twenty maunds of *goor*, but should the canes be particularly good and luxuriant, we may expect from thirty to thirty-five maunds!!!" This information there is *no reason* to doubt; it was given freely, and with evident pleasure, in an off-hand and candid manner.

Thus it is (in making Assameewar contracts) necessary, to stipulate for so many waterings, *ghorie-ings*, &c. according to the month in which you plant, allowing fair remuneration for such operations. This point being once properly understood by the Assamees, and confidence established, it only

* 24th April.

remains for the planter to ride every now and then over the whole of his cultivation, in order to ensure attention, and detect any attempts at shirking on the part of the Assamees. I am inclined to give especial favour to Assameewar cultivation, for many reasons; it saves an infinity of trouble, is not so expensive, is more sure, and better guarded. Besides which, I am quite persuaded, that by a little adroit management, the Assamees can be brought to use any improved plough, provided it is like their old implement, and does not strain their cattle. As to planting the cane (as will be treated of in the following page) in lines at regular distances, and trashing the same when required, they would not for a moment object to it.

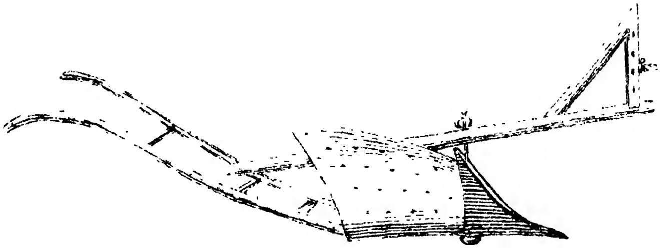
This system also causes a saving in the number of cattle and carts otherwise requisite on the estate, as the Assamees will always be willing to cart home the canes, at a fair rate per begah. A whole tribe of Lallas, Korindas, Peons, Chokedars, &c. all petty tyrants and extortioners, are got rid of, and altogether your business proceeds in a most quiet and satisfactory manner.

Having touched slightly on Assameewar culture, I will now proceed to shew how the cane should be planted.

In this operation I premise, that the two ploughs given in the sketch, are used as being exceedingly cheap and efficient. The double banking plough, No. 2, follows the single, No. 1, and throws up the banks on either side, forming a tolerably wide and deep furrow. In planting Otaheite, I always caused the ploughs to *return* in the *same* furrow, thereby greatly improving it.

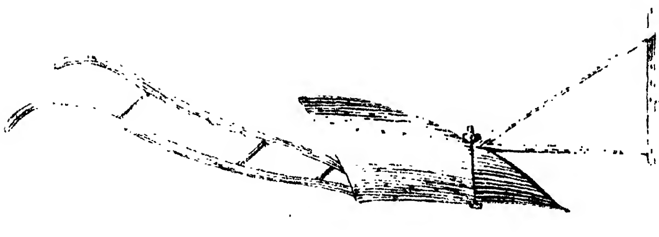
It being advisable to have your canes planted in *straight* lines, I would recommend the planter to have a stake (either painted white, or with some white substance wrapped round it,) at each end of the field, as distinguishing marks or beacons, to guide the ploughman in a straight course. These beacons can be shifted as each furrow is finished, by

N° 1



[illegible]

N° 2



Dou[illegible]ng Plough

IMPROVED [illegible] CAN [illegible]

a person appointed for that purpose, who carefully marks off the distance between each, from three to four feet, as his orders may be, and there firmly plants his stake, moving it onwards as required, until the field is finished. By this method you will have your canes growing in regular lines, instead of one confused and impenetrable mass, and the benefits which result need only to be stated. In the first place, there is no waste of land, next it will be observed, that in moulding, cleaning, banking, trashing, or cutting canes, each labourer takes his own particular row, and goes forward in one straight line from one end of the field to the other, without being interfered with by his fellows. Thus fifty men would carry up a breadth (as it is expressed,) of fifty rows, and in returning, would work down another breadth, and so on. Light and air would also be able to penetrate throughout the canes, and perform their parts in the elaboration of their juices; not to mention the greater vigour and richness of the canes, and the increased beauty of their appearance.

Immediately after the ploughs, the persons appointed to plant the cane, follow and lay the cuttings, or plant-tops along the furrows, at such distance apart, as may be most advisable. In rich moist lands, *four* feet will be necessary, in others, four feet by *three* feet, or again, three feet. Thus if four feet, your *furrows* must be four feet apart, and the cane tops placed four feet asunder in those furrows. If *by three,* then only three feet ; but if three feet every way, both the furrows and the distance of the plants must be *three* feet. This is a point which must be decided by the planter himself, according to situation and climate. The manner in which I have planted my own canes is here shewn, and it will be

— — 3½ ft. — — 3½ ft. — — 3½ ft. — — 3½ ft. — — 3½ ft. — —

seen, that I have allowed 3½ feet space between the plants, and as the land is rich jungle, only just cleared and brought into cultivation, I have had the furrows ploughed four feet

apart, and put only two cane tops together. Yet, *although* I *have* been thus indulgent as to space, many of my fields have grown up exceedingly thick, and when the rains come on, will be even still more dense.

In poorer soils and other situations, the number of cuttings may be increased, or the distances lessened.

As I before remarked, the cane planters follow the ploughs closely, and place the pieces of cane at proper distances, others again follow *them*, and cover the plants lightly with earth. In very *dry weather*, a covering of some depth is requisite, to preserve the moisture necessary to vegetation; and it is extremely desirable to have your field ploughed and planted, before the heat of the day can act to its injury.* In the West Indies, *cane tops* are always used in planting, and are undoubtedly the best part of canes for the purpose of reproduction, although it is well known, that any joint (having the *eye* uninjured) will grow and produce. These latter are usually termed " plant cuttings," and are commonly used in this country, both by Europeans and Natives.

About two or three weeks after being planted, the cane tops will have sent out shoots to the height of a foot or more, and if weeds then abound, the field must be carefully weeded, and the earth loosened about the roots of the young plants. Very small and light hoes are best for this work, and are usually provided. The weeders proceed with great caution along the furrows, and use with tender care the delicate shoots, whilst at the same time they draw a small quantity of mould from the banks, and apply it lightly to the roots. In the course of a month or six weeks, they will again require to be cleaned and moulded, when the remainder of the banks may be given them. These *operations* may be repeated at intervals, as may be deemed re-

* In hot, dry weather, as during March, April, and June, the native method of levelling and hangering *planted* lands is very good.

quisite, until they have grown into tolerable sized canes, when cleaning and trashing will be necessary up to the time of their being cut for the mill.

Trashing or stripping off the dry leaves may be divided into two systems; viz. trashing and booting. The former is of considerable importance in cold damp situations, or in the rainy months, when the canes require to be well cleared of all the dry and superfluous leaves which encumber them, and prevent the free admission of *heat*, *light*, and *air*.

Heavy trashing, is so termed, when it becomes necessary to strip the cane of every single leaf it can with propriety spare, that the solar rays, &c. may take greater effect, and conduce to the mature elaboration of its *then* weak and aqueous juices. Under the circumstances above noticed, if trashing be *not* practised, the canes grow up not only devoid of (but a small proportion of), saccharine matter, but also with so weak and fragile a stalk, that the first violent gust of wind blows them down, and completely destroys them. Trashing is more lightly performed, when the object to be attained is of less urgency. Booting is much in vogue (in Jamaica) on sea-side estates, where the lands are undulating; also in intensely hot and dry weather, or on soils which cannot bear exposure to the sun's rays. It consists in merely stipping off the trash about the roots of the cane, and allowing the upper leaves to remain as a shelter and protection. Some judgment is required in trashing canes, both as regards the proper time, and the extent to which it may be carried, so as to prove beneficial. I will explain the manner which I think most advantageous for this country, and may be practised without subjecting the cane to too great a degree of heat and exposure.

Planted during October, down to the period of the next year's rains, a space of eight months, canes do not require to be trashed, or even booted; but when the rains com-

mence, they grow so rapidly and become so densely thick, that it is a matter of necessity to clear the plants of all superfluous leaves, and admit as much light and air as possible. I, therefore, would recommend constant trashing throughout the rainy season, as circumstances may dictate. If to be cut in December, (early part,) then a light trashing about the middle of October, and again, ***each field in rotation*** (as they may be required for the mill) one or ***two*** weeks previous to their being cut. By observing this advice, the planter will have rich juice yielded him by his canes, which can be converted into a fine light colored, sparkling, strong grained, sugar.

I cannot conclude my remarks on this subject without mentioning a most interesting fact, presented to us by Professor Liebig, which I consider has strict connection with the trashing of the cane plant. He informs us, that all plants take their food and appropriate the nutritious parts to their sustenance, and void *any obnoxious* and refuse parts, as excrements.

He proves that plants have an infinite advantage over the animal creation in the matter of poisonous substances, which though often taken up from the soil by the roots with their natural aliment, pass through the body of the plant, rejected by the various organs of assimilation, and are finally voided in conjunction with other excrementitious matter. This singular property, Liebig has, by repeated experiments, proved to exist in healthy plants; but, should a plant be placed in circumstances calculated to impair or destroy the healthy action of its organs of assimilation, &c., it is but natural to conclude, that a depraved and sickly appetite will speedily follow, which will cause the plant to appropriate substances that are unwholesome and unnatural. Thus the rich flow of its sap becomes contaminated throughout, a valued vegetable is turned to poison, and a luscious fruit into a thing to be dreaded. In the "*sugar cane*" of the

vegetable creation, one of nature's *choicest* gifts, this can be exemplified by numerous experiments. Even under the special care of man, a want of knowledge and an injudicious mode of culture, not only cause this rich and valuable plant to yield very often but *one-third* of the quantity of produce, which it is capable of; but likewise so disorganizes the healthy action of its system, as to allow of the introduction and entertainment of foreign deleterious matter, to the consequent destruction of quality in its produce. Hence we find a great portion of the native-made sugars complained of, as being "soapy, clammy, &c." which causes the soil and species of cane (of which it is manufactured) to be spoken of as *bad*, whereas the fault in reality exists in the cultivation and manufacture. Let the cane be planted and maintained in a sufficiently open manner to ensure to it a proper proportion of air, light, and heat, without too great an exposure; *this*, together with common attention, will serve to keep the plant in a healthy state, in which case its organs of assimilation will reject any pernicious matter that may be supplied by the roots, and appropriate only those parts which are wholesome and nutritious. The juice will be clear, fair, and rich; it will boil quickly, and granulate kindly. Properly "*tempered*," it will yield a sugar of a desirable colour and large sparkling crystals, perfectly devoid of that greasy claminess, which causes so much complaint in the native made sugar.

(To be continued.)

Remarks on Hemp and Sunn cultivation in the North-Western Provinces. By H. Hamilton Bell, *Esq.*

I have thought much of Mr. Deneef's remarks on *Sunn*,* and his declared opinion that nothing is wanted but an improved preparation to make it a desirable article for the English market. The Hemp, if I may so term it, made here (Agra) from this plant, is scarcely a marketable article, the different villages growing only about the quantity they expect to require for personal use. The plant appears to me to reach about six feet in height in fair rainy seasons, requires scarcely any attention, and is, I imagine, a very inexpensive culture. I conjecture, that one cutcha beega would, on an average, yield nearly 40 bazar maunds of the green plant, and I suppose the cost of this could not exceed two rupees, but I cannot ascertain from the natives what relation heir coarse Hemp bears to the above quantity of plant, though Mr. Deneef may be aware of this generally, or rather of the proportion of his improved dressing to the green plant. A native who has just called here says, about 1-20th, but he does not seem to know much about it.

There would, however, be no difficulty in the cultivation of the *bhang* or *gunja*, which appears to be the true Hemp. At present, it is only sown for the intoxicating drug the natives obtain from it; but the vigour the plant shows, and the height it reaches when thus sown, much scattered to admit of its throwing out its branches, satisfied me that sown more densely, it would at the least run the height of Sunn, and this I suppose sufficient for the desired length of fibre in the Hemp.

* The fibre of the Crotolaria juncea.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

INDIA.

No. IV.—1843.—Vol. II.

Suggestions for the better transmission of Plants from one part of India to another. By Robert Wight, Esq., *M. D.*

Coimbatore, 13*th May*, 1843.

At page 36 of the second volume of the Society's Journal, there is a subject of much interest discussed; namely, the cause of losses sustained in the country, during the transmission of living plants, in Ward's cases. As this is an inquiry in which nearly all of us take an interest, I beg leave to contribute my mite to existing information, in the hope of its proving the means of directing inquiry to what appears an unsuspected cause of loss and injury, the remedy for which is simple, and easily applied. The source of all the injury recorded in Dr. Falconer's report, is, I suspect, simply *over-watering* in the first instance, a blunder into which native gardeners, acting on their crude ideas of the necessity of plenty of water, are very liable to fall.

In December 1841, a few days before leaving Madras, Lord Elphinstone received a box of plants per Steamer, direct from the Botanic Garden, and which probably had not been

enclosed above ten days. As they did not seem to look well, his Lordship requested me to examine the case. On opening it, I found the soil very moist, and large drops of condensed vapour trickling down every glass. The plants, which bore all the marks of having been in the most thriving condition but a few days before, were all sickly, and the young and tender shoots blighted and mouldy.

Satisfied from these appearances, that the sickly state of the plants was a very recent occurrence, and suspecting that it originated in excess of moisture, I directed the soil to be freely loosened, and the glasses to be removed for the purpose of promoting evaporation. After four days exposure to the air, the surface soil had become dry and powdery: the case was then reclosed, without giving water, and entrusted to my charge for conveyance to Ootacamund, a month's march. On opening it there, every plant was alive, and most of them had regained their healthy appearance, which I attribute, simply to the removal of excessive moisture promoting transpiration from their leaves.

As this source of injury is one not likely to be suspected of producing such fatal results, and may be easily overlooked, I have deemed it desirable to direct attention to it, in the hope, that persons having opportunities, may be induced to institute a series of comparative experiments, to determine how far the inference I have drawn from a single case is well-founded.

My deduction rests on physiological principles, and I have not the least doubt, will be found correct; but as there are many matter-of-fact people, who prefer tangible facts proved by experiment to theoretical principles, I trust Messrs. Griffith and Speede, and any other Members, who may feel practically interested in the question, will be induced to subject these views to the test of experiment, and determine, to what extent the soil, in such cases, should be moistened, before closing them.

Experiments made at Ceylon on Carolina Paddy, obtained from the Agricultural Society of India. Communicated by the Honorable P. ANSTRUTHER, *Esq., Colonial Secretary.*

Kandy, 29th March, 1843.

The Carolina paddy seed sent me has been distributed; it has failed in many cases, but in some it has succeeded. I enclose a report I have received from the Province in which it has succeeded best.

REPORT.

Ilpecarve, 4th March, 1843.

The Adigar of Mantotte Vendergone Modr. states: I received some paddy from Mr. Dyke with a letter, desiring me to cultivate it carefully, and report the result. I cultivated it in a field adjoining my residence, after manuring and preparing the ground in the usual manner for growing paddy; the quantity of paddy received from Mr. Dyke was about one-eighth of a quart, which quantity has yielded four quarts; it would have produced more, but the constant rains injured it; the paddy was not sown until very late in the season; the paddy was stated to become ripe in six months, that sown by me was ripe in four; the paddy is like that called Ele-nello, it is of a good and productive kind. I say so from the appearance of the ears, and the quantity of grain they contained. I consider the paddy well adapted to the soil of the district. I will shew the paddy to the Acting Agent at Mantotte. I intend to sow all four quarts in my fields next season; the produce I mean to distribute amongst some of the principal cultivators at Mantotte. I will give some to the Adigar of Nanathan, and request him to try it in his division. Some people of Mantotte have spoken to me about the paddy, observing it to be of a peculiar kind. There is no peculiarity in the manner in which this paddy grows, it appeared to me to require weeding— which the paddy which is ordinarily cultivated in this dis-

Carolina Paddy.

trict does not require. Next season I mean to try it in two ways; viz. sow some before the ground is wet, as done in the Jaffna districts, and some after irrigating the field, as done in this district.

Mantotte, 10th March, 1843.

The Adigar of Mantotte produces about three and a half quarts of this paddy. It appears to be of a fine description; a sample of it is taken for the purpose of its being forwarded to Government.

The Modliar of Meelpatto, 8th March, 1843.

In reference to the order dated the 2nd instant, (which was received by me on the 7th,) on the subject of the paddy which had been sent me by the late Agent, Mr. Dyke, I beg leave to report, that I cultivated the paddy, and it is in crop, it will require fifteen days' time to be fit to be reaped, and as a specimen, I herewith send some ears. After the paddy had been sown, it was injured by rains, but what escaped being damaged thrived well, and has produced well. I am unable to state any thing as to the quantity of paddy, before the crop is thrashed.

Jaffna, 16th March, 1843.

The Cangany of the Cutchery states: I received some paddy from Mr. Dyke, with directions to cultivate it in the ground attached to the Cutcherry dwelling. I sowed the paddy in the month of October last, after manuring the land; the land is not of that description of soil on which paddy is sown, the ground is garden land, on which dry grain alone can be cultivated profitably; but as I manured the ground well, and watered it frequently, I obtained a tolerably good crop, on an extent of three-quarter lachams of ground. I sowed half a quart of the paddy, which has yielded twenty-eight quarts; this is considered a fair rate of

produce for a certain description of paddy land. I could not expect more from the ground I cultivated.

The paddy is of a peculiar description, there is no paddy of a similar description in the district. I consider that the paddy is of a productive kind, and that it might be profitably introduced into this district. I have orders from Mr. Dyke to sow the produce again in the same garden.

True Copies,

(Signed) J. Price, *Acting Agent.*

rther particulars regarding an Oil-giving Plant, which grows spontaneously in the District of Bolundshuhur. Communicated by Thomas Tonnochy, Esq.

Bolundshuhur, 29th April, 1843.

I have now the pleasure to send accompanying, a specimen of the drying oil seed plant; it has a variety of names at different places, but is generally called "*jy,chee.*"

The plant, as I have said before,* grows spontaneously in fields sown with the grain of the rubbee harvest, and comes to maturity about the same time with the crops; it is not considered a baneful weed. A most remarkable feature in its production is observable in connection with the alternation of agricultural crops which prevails throughout the country, for I have not been able to find, that the seed, at the season in which it should germinate, has come up on land on which it had been *last* shed, when that land has in rotation been sown with the khureef crops. The plant, however, in its natural profusion, begins to appear along with the rubbee crops, on land on which its seed had been deposited *a year before.* For instance, the plant now growing, or which has grown along with wheat, barley, and gram, (for all these have already been cut,) will drop its seed

* See No. 2, of Vol. ii. p. 52.

in May 1843. In June-July following, this land will be ploughed up for the khureef harvest, and be perhaps directly sown with joar, bajra, or any other rainy weather grain. In November, the crops produced upon it will be reaped. About this time the rubbee harvest is being sown on other lands, and along with it, the *jy,chee* will also appear, but not upon the naked joar and bajra land, upon which its seed had been shed a season later than upon the other; on which it will not come up till November-December 1844, and perhaps not then, unless the land be sown with the rubbee grains. Plants may indeed be seen on land occupied by, or from which a khureef crop has lately been reaped; but they are stragglers, the seed of which might perhaps have fallen on spots containing some peculiarity for its growth out of the common order, just the same as the plant will grow far and wide, on waste and uncultivated land.

I sowed the *jy,chee* at the proper season, and by itself, on land purposely and carefully prepared for it; it would not come up. Again, large quantities of the husk, (which must undoubtedly have contained large portions of whole seeds,) were thrown before and during the rainy season, into a field as manure. This field was afterwards prepared for and sown with oats, which were nearly choked from the profusion, nay in thick layers, with which the *jy,chee* came up; while, in another field, on which the *jy,chee* husk had been similarly thrown, but which happened to be sown with joar, the seed allowed the germinating season to pass over undeveloped, and only made its appearance when that land was last year sown with oats; it is from this field that I send the specimen. Of course the *jy,chee* upon it is few and far between, but it is still to be seen all over, its thinness being owing to the weeding which the field underwent. I beg the above observations may not be taken as conclusive evidence of the fact; they were superficially made, and a close study alone can go towards completely establishing

it. I have stated what struck me, with the view of obviating the effects of any sudden unexpected check, which people might meet with in a first instance in their attempt at cultivating the article: for unless it can be cultivated "agriculturally," it can never become a staple article of produce, or of extended commerce. I shall be rejoiced to know, that it has no natural affinity with the rubbee crops, and that it will equally well come up by itself. I mean not to give up my trial, and will let the Agricultural Society know the results. The plant in its luxuriant state grows about 2 feet high, and about 3 in circumference. The seed after it has been husked, that is, divested of its outer coating, yields about $\frac{1}{5}$ to $\frac{1}{4}$ of its weight of oil, the quantity depending upon the maturity which the seed had attained at the time of being gathered. I have little doubt but that cultivation will greatly enhance the productive quality of the plant in seed and oil

---

[The above communication, with specimen of the plant alluded to, were submitted to Dr. Griffith, and the following are his remarks thereon:—

"The plant is a genuine Euphorbia, what species I cannot say, nor could any one else in India. I have gathered it at Loodianah, and doubtless it is known, as it must have been collected by Messrs. Royle, Edgeworth, and Falconer. The family to which it belongs, is an oil-giving family; witness the castor oil, and one species is said to be used by the Chinese as a varnish; but I find no mention of *drying oils*.

"Mr. Tonnochy's letter is very interesting, and the facts mentioned in it are perhaps explainable, but he will doubtless put the thing farther to the test."

Dr. Griffith has transmitted a fragment of the plant to Dr. Royle.]

Notes on the Pandanus Vacoa, or Screw Pine, recommending its culture in Bengal, &c. *By* T. F. HENLEY, ESQ.

Calcutta, 13*th June,* 1843.

I have the pleasure to present the Agricultural Society with a quantity of seeds of the Pandanus Vacoa, or Screw Pine, the plant to the leaves of which the Mauritius sugar planters are indebted for the strong and excellent bagging material employed by them.

The superiority of the material afforded by this plant over the Indian gunny; the cheapness with which it may be produced; and the facility with which it may be manufactured into bags, at once recommend its introduction most strongly into this country, by every one desirous of improving a most important, though humble object of industry. With this view, and in the hope of being instrumental in introducing it into extensive cultivation in Bengal, I have collected the lot of seeds which I have now the pleasure to present, together with some notes of the processes employed in the manufacture; a few specimens of the leaf in the prepared state, and of the manufactured bag.

I may premise, by stating that I have no where met with a correct description of this, I believe the only truly useful variety of the Pandanus. I say useful, for amongst the numerous varieties I have met with, none other produces a strong and durable leaf. I should mention, however, that amongst the varieties found wild on the sea-shore of Ceylon, one description is manufactured into bags, but of so inferior a quality that the Bengal gunny is still imported, and exclusively employed for coffee packing. I am glad to have had the opportunity of introducing the variety into that Island, where it has completely succeeded, and where its good qualities will doubtless soon call it into extensive existence amongst the European coffee planters. There is a variety to be met with very commonly in sandy soils about Calcutta,

and which I believe to be the Pandanus odoratissimus, the leaf is however totally worthless. Its existence in the wild state in this country is however a useful fact in the present enquiry, as it would indicate, by analogy, that the soil and climate are not unfavorable. I have also had occasion to observe a splendid variety in the Maldive Islands, with leaves of six to eight feet long: struck with their promising appearance, I collected a few and dried them, but found, unfortunately, they were weak, brittle and valueless. The fruit of this variety is eaten by the natives, but is very coarse.

In that excellent general work on Natural History, the Penny Cyclopædia, the Pandanus family is described as having the male and female flowers separate, but on the same plant, and a drawing is given representing that arrangement. Now in the Mauritius variety the male and female flowers are distinctly on separate plants. Throughout all the varieties, the fruit, flower, and leaves have a remarkable resemblance, leaning always towards that of the pine apple in the fruit, and with the male flower like a pendant bunch of Ostrich Plumes, possessing an agreeable perfume.

The Mauritius variety is said to be a native of Madagascar. It rises to the height of about thirty feet, when permitted to do so, but in general the cropping of the leaves, which commences in the third year, keeps the plant down to the height of some six to ten feet. Indeed the most useful period of its existence is, when in all the luxuriance of its youth it has not more than four or five feet in height, composed principally of a rich crown of leaves arranged spirally, (hence its name screw pine) around the stem. When the plant has attained a few years old, the stem sends down shoots or suckers, plain, round, fibrous cylinders of about two inches in diameter, these proceed downwards to the earth, often performing an ærial voyage of three or four feet (although totally without leaves) till they reach the ground and take root. These suckers, or rather gigantic rootlets;

are employed for making paint brushes for common purposes, such as painting carts, outhouses, &c. and answer very well, the fibre being tough and durable.

This plant prefers dry situations. In Mauritius it is usually planted along the sides of the cane fields, roads, or anywhere, in fact, where it will occupy the least valuable space. It requires no care or cultivation beyond that of preventing its being choked by long grass in its infancy. The dry bank or ditch is its proper element. About the third year the first crop of leaves may be taken off, which is done with no sparing hand, as the splendid fan-shaped crown of leaves is nearly all removed, and only a small central tuft left, hardly sufficient to continue the existence of the plant. The operation of removing the leaves is performed with any ordinary knife; they are cut off close to the stem, so as to obtain them as long as possible. The leaves thus removed from a healthy young plant, may be from three to five feet long and upwards. In old trees the leaves are too short, and are not employed.

The plant requires two years ere it can be cut a second time, when it will yield a similar crop; that is, sufficient for the manufacture of two bags. A plant thus yields on an average one bag per annum. As it requires about two and half pounds of dry leaves to form a bag, we may safely assume four times that weight of leaves in the green state, or about 20lbs. of green leaves for its biennial crop.

In manufacturing the leaves, the process must begin with the leaves in the green state, and as fresh as possible from the tree; without this precaution, they become tough, and do not split freely into the bands or filaments, employed in the manufacture. The superannuated laborers, invalids, nursing women, and children are generally occupied at this easy task of splitting and matting the leaves, on the several estates. The splitting of the green leaf is simply performed with a bit of sharpened hoop iron, or bamboo. A familiar

idea of the leaf may be obtained by comparing it to a gigantic pine apple leaf.

The serrated edges of the leaf are first removed as close as possible to the outer edges; this is done by inserting the blunt knife at the lower part of the leaf, and running it along from bottom to top. The longitudinal arrangement and structure of the leaf are such, that it divides easily in the direction of its length. The middle rib of the leaf is then removed in the same manner, and the leaf, now in two parts, is again split up, each leaf thus yielding four bands or fillets suited to matting purposes. The size of these strips depends on the dimensions of the leaf from which they have been produced, and are in general from three to four feet in length, from three-quarter to one inch breadth at the lower end, and terminating in a point.

They are now tied together by the points in small handfuls, and spread out to dry in the sun. They soon become compact and coriaceous, and when dry, of great strength; one good fillet will support the weight of a bag of sugar, or about 140lbs. without breaking. When dry they may be stored in magazines, and kept for any length of time, being little subject to rot or deterioration, in which respect this material has a great advantage over jute.

In manufacturing it is usual to give out two and half lbs. of dry leaves for each bag; the waste is about half a pound, and the usual task for the inferior or superannuated is three mats, task work, per day. Able women who employ themselves in this manufacture as a means of livelihood, produce five to six mats or bags per day, besides attending to their domestic concerns. No loom is required, the operation is performed seated on the ground. With the feet a few elementary plants are put together, and the fabric soon spreads forth without that painful attention which the rudest process of loom-weaving invariably demands.*

* Vide specimens accompanying of manufactured bag.

It is unnecessary to dwell here upon the manner of weaving the strips into mats: the act of matting being at least as well known in India as in Mauritius; whilst it is probable there is no material in the former country so easy of combination as that to which we here allude. Assuredly the date leaf now manufactured into bags in Bengal, having leaves only a few inches long, must involve ten times the pains and labor, whilst the resulting bag is incomparably inferior. The gunny is as superior to the latter, as the vacoa is to the gunny.

If we consider for a moment all the details necessary to the production of a gunny bag, we shall at once perceive the advantages of the vacoa, were the qualities even equal, which however they are not. To produce a gunny, the land must be ploughed, prepared, manured, sown, and rent paid. The crop must be cut, steeped, and the fibre carefully separated, requiring great attention and skill in the water retting, not to rot and injure the fibre in the steeping. It must be now carefully dried; a risk of season incurred, injury from heating avoided, as paut or jute (Corchorus olitorius) is perhaps the most delicate of all the Indian fibrous plants. And now the regular details of spinning into thread must be passed through. Thence it passes into the hands of the weaver, where it requires the assistance of paste, and all the little indefinite aids and skill of an intelligent workman. Compare all this detail with the simple process of the vacoa leaf; and which is, in conclusion, superior in strength, durability, and commercial value, and the importance of paying every attention to the introduction and extensive distribution of this valuable plant throughout the country will appear too obvious to need being dwelt upon.

Annual supplies of seeds may be procured from Mauritius, and particularly Bourbon, at a small expense, I should say from an experiment on the price of collecting, at about six rupees per 100 French pounds, in the Islands. Such small

supplies as I may personally procure, shall always be at the disposal of the Society.

The planting of the seeds requires but little care. They should be placed in a nursery in the first instance, each seed about six inches apart, and covered with about two inches of any free and fertile mould. The young plants will soon shoot forth, and when of about nine inches high, may be removed to their final destination, and kept for a short time free from weeds. They will not bear inundation.

Sugar Planters should include this plant amongst their operations, sowing at least one for every hundred weight of sugar their operations may require. The native cultivators, it may be supposed, will take up the cultivation as soon as its advantages are made apparent to them through European, or the example of such native gentlemen as take a sincere interest in the advancement of their country.

In conclusion, I believe it, in my humble opinion, the duty of the Agricultural Society to afford to this valuable plant, that sustained aid and stimulus to its introduction which it merits, and which the Society is alone in a position to afford.

[The Committee of Papers have pleasure in giving publicity to the above communication, under the impression that it contains much useful information regarding the Vacoa, and that the introduction of the plant into Bengal might prove advantageous, though not perhaps to the extent pointed out by the writer. The leaf is no doubt in every respect preferable to that of the date, but there is no trouble in obtaining the latter, the tree being grown for other purposes, while the slow growth of the Vacoa, may prove a bar to its cultivation by the Ryots. The seeds have been sown in the Society's garden with a view to assist in carrying out the laudable object of Mr. Henley, but it is doubtful whether the plant will become sufficiently naturalized here, or succeed so well in cultivation, as to supersede Bengal indigenous fibrous plants. It may however be mentioned, that species of Pandanus are commonly employed in Burmah and the Straits for matting, &c., and if we are to supersede jute, &c., it is presumed it will rather be from the Pandanus of Burmah, than that of Mauritius.]

Remarks on a few Shrubs collected in Affghanisthan. By Lieut. VINCENT EYRE. *With further observations thereon by* WILLIAM GRIFFITH, ESQ. F.L.S.

Meerut, March 21st, 1843.

I have the pleasure to enclose a few seeds of two some what remarkable Shrubs, peculiar to the country betwee Attock and Jellalabad, which may be acceptable for th Botanical Garden.

No. 1, is a species of Asclepiadaceous plant, called by th Seiks, *Veuna,* in appearance resembling a Daphne, and ver ornamental. It abounds on dry stony plains, and is in variably found in company with No. 2, a Solanaceou shrub, also ornamental, the leaves of which are often use to curdle milk. No doubt both of these plants have bee noticed by Dr. Griffith, but it is possible he may not hav had an opportunity to collect the seed. As I find my forme notice* regarding the gum Ammoniac plant of Cabul excite some attention, I am happy to be able to enclose a smal specimen of a stalk of the actual plant in flower, which I plucked close to the celebrated Secundur Minar, or Bactria Pillar, when I passed that spot a prisoner in May 1842. It was not full blown, but perhaps Dr. Griffith may be able to determine the genus on examination. The ripe seeds of th plant were sent on a former occasion, as also some speci mens of the gum collected by myself, which I hope reached the late Secretary safe.

The fragment of the plant, which Lieut. Eyre considers to furnish the Gum Ammoniacum, appears to be, judging from the seeds, a species of Ferula, which genus is the source of the Assafœtida of the Materia Medica. Lieut. Eyre's

* An abstract of Lieut. Eyre's former communication will be found in the pamphlet of Proceedings of the Society for November 1841, and the entire paper at page 202 of the first volume of the Journal.

plant is common on hills in Central Affghanisthan. The specimen of the Gum Ammoniacum of Lieut. Eyre, purchased in the Cabul bazaar, is stated by Dr. McClelland to be deficient in the peculiar smell and flavour of the veritable drug; the tears also are much larger, so that there is no sufficient reason for supposing the plant to furnish the Gum Ammoniacum. The second plant is a novelty to me: it is a species of Viscum or Misletoe. The seeds of the "Daphne-like" plant belong to an Apocyneous genus, considered by Dr. Falconer to be a species of Rhazya of M. Decaisne, founded on an Arabian plant.

The other seeds belong to a Solaneous genus, probably undescribed; both these plants are very common on the frontiers of Affghanisthan at low elevations, and in the Jellalabad Valley to the Eastward of Gundumuck.

Memorandum accompanying a few logs of Oak from the Chittagong Hills. By A. Sconce, Esq., *Collector at Chittagong. With a report on its quality, by Captain* A. H. E. Boileau, *Bengal Engineers.*

The accompanying are a few logs of Oak, which I have had cut and brought down to me from our hills. May I ask you to get a report upon the quality, and probable applicability of the timber. Those I now send you are not very large. One is about fifteen or sixteen inches in thickness, but others are to be had larger, and in abundance. My question is, therefore, is this wood calculated to be of use in ship-building, or of general marketable use in other ways? All I can say now by way of description is, that the timber is hard and heavy—so hard and heavy, that it is not used by the natives. What I send you, being fresh cut, is green wood. The spontaneous production of the forest is not beyond the scope of the Agricultural and Horticultural Society.

The log of Indian Oak Wood, which the Agricultural Society has sent to me for examination is, I think, likely to be useful in Naval Architecture, and for domestic purposes. It is buoyant in water, its specific gravity being about ·756, and is a hard, strong-grained timber. Two pieces, each twelve inches long and one inch square, were submitted for trial in the Fort: one broke under a strain of 1490 lbs., the points of support being six inches asunder; but the other piece required a load of 1882 lbs. to break it, the difference being 0.2, or one-fifth of an inch.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. V.—1843.—Vol. II.

Correspondence relative to a remarkable variety of Caoutchouc, termed Gutta Percha *or* Gutta Tuban, *its properties, and the probable uses to which it may be applied. Procured at Singapore by Senior Surgeon* Montgomerie, *and accompanied by experimental observations as to its chemical nature, &c. by* Fred J. Mouat, M. D. *(Presented to the Society by permission, and on the part of the Bengal Medical Board.)*

No. 113.

To F. J. Mouat, Esq. M. D. *Chemical Examiner to Government.*

Fort William, 16th June, 1843.

Sir,—I am directed by the Medical Board to forward to you the enclosed copy of a communication No. 16, dated 1st March last, from Senior Surgeon W. Montgomerie at Singapore, and accompanying packet of the substance therein alluded to, with a request, that you will have the goodness to ascertain its properties, and the purposes to which it may be applied.

Judging from the appearance of the Bougies rolled up by Mr. Montgomerie, of which a specimen is herewith offered for your examination, the Board are inclined to think the substances may prove useful at least in the manufacture of such instruments as Bougies, Pessaries, Elastic Catheters, Gum Elastic Bottles for Enemas, &c.

I have the honor to be, &c.

(Signed) J. MARSHALL,

Inspector General and Officiating Secretary Medical Board.

No. 16.

From Senior Surgeon W. MONTGOMERIE, *to the Secretary of the Medical Board, Fort William.*

Singapore, 1st March, 1843.

SIR,—I have the honor to request, that you will lay before the Medical Board, the following short account and accompanying specimens of a substance called by the Malays, Gutta Tuban or Gutta Percha.

It is the production of a large forest tree indigenous to Singapore and the neighbouring countries, and is procured by cutting through the bark, when a milky juice exudes. I am informed that the produce from one cut is not very abundant, and ceases to flow after a time, but that the tree continues to give it forth, after being again cut into for the purpose.

Soon after the juice is collected, great part of it coagulates into a substance, which continues white if excluded from air and light. When dried in thin layers exposed to the atmosphere, it very much resembles scraps of leather.

It appears from some very imperfect experiments to resemble Caoutchouc in its chemical properties, but is much less elastic.

It, however, possesses some qualities which I think will render it a valuable substitute for Caoutchouc, in the forma-

tion of Bougies and Catheters. Instruments made of the latter substance invariably get spoilt when kept for any length of time in a hot moist climate, and I believe that this is in a great measure the consequence of its being necessary to use some of the essential oils or naphtha, as solvents for the Caoutchouc; but this is quite unnecessary in the formation of instruments of the Gutta Percha, it being only necessary to plunge a piece of the Gutta of the proper size into water heated above 100 of Fahrenheit, when it becomes quite plastic, and may be readily moulded into any required shape, and rolled quite smooth between two smooth surfaces; it retains the form when cold, and is more rigid and harder than India rubber at any temperature below 110 of Fahrenheit; it possesses also the valuable property of fragments of it being perfectly united when dipped in water heated near the boiling point.

It, however, more readily than Caoutchouc receives marks and dents from pressure in contact with rough hard surfaces, and such collision must be avoided.

I am of opinion that Bougies formed of the Gutta Percha will be found very serviceable in cases of deep-seated strictures, when it may be required to have the body of the instrument firm and rigid; as one of the full size may be used by merely dipping the point into hot water, and an inch or so of it may be moulded between the fingers and thumb to any required size, and rolled smooth on a table with a paper folder, or any thing of the kind most readily at hand, and in the course of a few minutes it will be fit for use.

From its being so plastic and readily united, it will also be found very serviceable in the formation of Catheters or Canules.

I have not been able as yet to get the flower or fruit of the tree producing this Gutta. The situation from whence the specimens I have obtained were procured, is in the forest about six miles from the town of Singapore, at a place much

infested by tigers, and to which it is necessary to proceed on foot, so it would be an adventure of some risk to proceed to the spot; but I have offered a reward for specimens of the flower and fruit of the tree, and am in hopes of being able to procure some ere long.

I am informed, that the fruit is as large as a pigeon's egg, and produces a concrete edible oil, so in all probability it is not one of the figs.

Herewith I have the honor to transmit some of the substances: three Bougies which I have attempted to make by simply rolling the Gutta on a common table under the hand, and afterwards with an ivory paper cutter; they are of course very imperfect specimens, but sufficient to shew, what under skilful manipulation may be made of it.

I also send the handle of a chopper as made by the Malays, and for which purpose the Gutta is preferred even to horn.

I have the honor to be, &c.

(Signed) W. MONTGOMERIE,
Senior Surgeon.

(True Copy.)
(Signed) J. MARSHALL,
Inspector General.

(True Copies.)
(Signed) FRED. J. MOUAT, M. D.
Chemical Examiner to Government.

JAMES HUME, ESQ. *Honorary Secretary, Agricultural and Horticultural Society.*

SIR,—By permission, and on the part of the Medical Board of Bengal, I beg leave to forward to the Agricultural Society, the accompanying specimens of a substance resembling Caoutchouc, together with a communication from Surgeon Montgomerie, regarding the properties and probable uses of the "Gutta Percha."

2. From an extended series of experiments, I imagine the substance to be a variety of Caoutchouc, possessing some

properties differing from those of the ordinary kind found in the market.

The action of the concentrated mineral acids is more energetic upon it; sulphuric acid softening, charring, and converting the greater part of it into a soft, black mass; nitric acid decomposing and converting it into a light, porous, friable bright yellow substance; muriatic acid exerting scarcely any action upon it. It is not affected by the caustic alkalies.

It is insoluble in water, alcohol, and nitrous ether; slightly soluble in sulphuric ether, washed with water;—sparingly dissolved by Burmese naptha, (for which I am indebted to the kindness of Mr. McClelland, Deputy Apothecary General,) at the ordinary temperature of the atmosphere, but readily taken up on the application of a sustained and moderate heat, by means of the common sand or water bath. Its solution, of which I forward a specimen, appears well adapted for all the purposes to which the ordinary kind is applied, in the manufacture of water-proof cloths, &c.

In oil of turpentine, it is freely taken up at the ordinary temperature of the atmosphere, from which it is readily obtained on drying, in an adhesive semi-glutinous state, possessing no elasticity.

It is soluble to some, but not a great extent also in volatile oils. I have not yet tried it with any fixed oil.

On the application of an elevated temperature in a closed vessel it melts, and on cooling forms, as in the case of common Caoutchouc, a semi-fluid tarry matter, which on being exposed for two or three days to the air in thin layers, becomes hardened.

In the open air, when sufficiently heated, or on the direct application of flame, it burns with a dense, yellow flame, giving off a very large quantity of smoke, and leaving a small residue of black, tarry looking, incombustible matter. Exposed to destructive distillation, it produces a consi-

derable amount of an oily substance, which I have not examined.

In the condition in which it is sent by Mr. Montgomerie, it is of a pale pinkish colour, having a leathery feel and look, with a peculiar odour. It softens readily in hot water, and may be moulded to any form. On cooling, it possesses scarcely any elasticity, but an extraordinary degree of tenacity, which will render it suitable for many purposes, besides the manufacture of surgical instruments. I forward samples of it in three states; viz., as a rigid, unyielding ball, slightly elastic; a slender rod, or bougie; and a flat portion, which was rolled out, when in a warm and plastic state.

My observations entirely confirm those of Mr. Montgomerie, but I do not think it applicable for the manufacture of elastic bottles, or any other articles of which elasticity is one of the most essential qualities. Its not being affected by the ordinary heat and moisture of the climate in this country, is an extremely valuable property, which may yet be turned to good account, and its extraordinary tenacity may cause it to be applied to purposes, for which the common variety is not at all adapted.

I should be glad to know from any members of the Society, familiar with the subject, whether the present is altogether a new variety, or one previously known in commerce, and whether it is identical with any found on the Continent of India. I should also feel much obliged by being favoured with specimens of the different kinds sold in the bazars, and if possible, the fruit and inflorescence of the trees from which they have been extracted, with a view to their identification.

I have the honor to be, &c.

(Signed) FRED. J. MOUAT.

Medical College, 10th July, 1843.

The Sugar Planter's Companion.

By L. Wray.

[Continued from page 83.]

Mode of Culture, comprising Ploughing, Planting, Moulding, Weeding, Trashing, Carting, &c. &c.

During the progress of the cane towards maturity, it is often found to put forth a number of shoots from the joints of its stalk, by which a very large proportion of the saccharine principle is lost, and the cane becomes more and more poor in its juice. This is especially the case in the rainy season, when great attention must be paid to this matter. Whilst cleaning or trashing the cane, orders must be given to the people to strip off every shoot they can find on the cane stalk, and at the same time uproot any puny sprouts which may be springing up from the roots, as they never come to any good, and only serve to rob the older and vigorous canes of a great portion of nutriment.

The "flowering" or "arrowing" of the cane, without doubt also deprives the plant of a pretty large quantity of saccharine matter, although many persons argue differently.

In places *where* the cane PERFECTS its seed, it must be apparent to any one, that the loss of sugar in the plant is necessarily very great; for we are well aware that all seed, in a state of perfection, contains a quantity of sugar, which enables it to support the infant plants, until its roots and leaves are of themselves sufficiently old to supply the requisite degree of nutriment.

This brings us to the period at which the cane is fit for "*cutting*," and when its juices are supposed to be properly matured for the purposes of sugar-making.

The cutters arrange themselves according to the rows, each taking one, and continue in *that* to the other extremity

of the field, by which system the cane-field is cut in a neat and regular manner, and should any bad work be performed, the careless person is readily detected. The instrument used in cutting is a hand bill, with a slight hook.

The labourers must cut close down to the root, leaving no stump; then holding up the cane by the top leaves, cut *off the stalk, leaving only three entire joints attached to the* leaves, which by another cut are also taken off, these latter pieces forming what is denominated, *plant tops*. Women and children follow the cutters, who tie up the canes and plant tops (in separate bundles,) and throw them in conspicuous heaps, for the cartmen and loaders as they come round. For tying the bundles, the cane top leaves are used, and answer the purpose admirably. By the carts, the canes are conveyed to the mill yard, in order to be crushed, and the *plant tops* are taken to any field about to be planted, and there covered up until required. The cane tops, or upper leaves, are, in the West Indies, also carted from the field to the cattle pens, and form a most nutritious and welcome food for the cattle, and all other stock on the estate.

* * * * * * * * * *

Having traced the cane plant from the time of its being first planted, through the different stages of its growth up to the period of its arrival in the mill-yard; I will proceed to notice, in the next place, the *sprouts*, which spring from the roots of *plant canes*, and form the hope of the ensuing year's crop.

In a fortnight after cutting, a number of young sprouts will shoot up from the clumps of roots left in the ground, and speedily claim the kindly aid of the planter. These sprouts proceeding from "*plants*," are termed, 1st, *rattoons*, which, although they do not yield juice in such abundance as their predecessors, nor attain so large a size, yet in Jamaica

give a sufficient quantity to produce from 1800 to 2500 lbs. per acre of very excellent sugar.

When the young rattoons have attained the height of a foot above ground, the planter will send in labourers, to remove the old dry cane leaves from about them, and at the same time loosen gently with hoes the soil around the roots; but should any of the roots fail to sprout, dig them out, and *at a proper depth plant two fresh "plant tops," so as to supply the deficiency. This work is generally termed* "turning trash," and supplying canes, on such and such a field, as the name may chance to be.

As the young rattoons advance in growth, they are moulded, cleaned, and trashed, in the same manner as their predecessors; only it must be borne in mind, that they cannot stand such heavy trashing.

If the soil be rich and strong, or properly manured, canes will continue to rattoon for years;. but it cannot be here advised *how* long it would be proper to task them, as this point must entirely depend on the nature of the soil, description of cane, and produce yielded. The planter himself can best decide this matter, as he is supposed to know how much is produced from each field, and can regulate his planting accordingly.

In Jamaica, we often hear of 16th and 20th rattoons, which the books of the estate incontestably prove, have not been regularly dug and planted during that space of time, yet continue to yield a good return, year after year. This may be evidenced as a remarkable fertility and strength of soil, yet it cannot be denied that, where the system of "*supplying*" is in vogue, the greater part of the original plants have given place to more recently supplied stock.

Carting canes home to the mill yard, is an item of great amount in any country; but to confine ourselves to India, we must take into consideration the scattered and extended

nature of the estates hitherto attempted, in various parts of the country by Europeans.

An estate to succeed, in its fullest sense, must be small, compact, and manageable. Five hundred acres *in Jamaica*, was considered, even in 1830, a very large estate, and I think I may, with great propriety, denominate the same quantity of land a very large estate for the East Indies in 1843. Even in the event of a planter obtaining that amount of land in *one* spot and as concentrated as possible, yet to work off that crop, would fully occupy a whole season, allowing that a steam engine, and a boiling house, with a double set of boilers, were at work, whilst the cartage would amount to a considerable sum, under the most favourable circumstances. But where lands are only to be obtained from the Assamees, in small detached portions, the absurdity, nay, madness, of extending an estate over a space of perhaps some five or ten miles, becomes strikingly apparent. We will not now speak of the injury to the canes themselves, but merely touch on the expence of carting them to the mill. To form an idea, we must find what number of cart-loads a Goruckpore beegah (two thirds of an acre) will yield. This I have found by experience to amount to sixty *native cart-loads*, or even more. The hire of Assamees' carts, say at the very cheapest rate, would be four annas a day, but far more probably, six annas. Let any planter imagine the cost of bringing to the mill canes planted at such distances, even at the low rate at which carts are obtainable in this country, and he must be astonished at the infatuation displayed. This is the rock which often causes the wreck of East Indian sugar planters. The raging mania appears to be for enormous estates, with fields straggling over the country from Dan to Beersheba; which system can never answer.

Manures, chemically considered, &c. &c.

In manuring lands for canes, the first question which arises is the object we have in view, and the means by which we can most effectually accomplish it. This object, then, appears to consist in an endeavour to keep up the fertility of our lands, by replacing every year, in the form of manure, as large a quantity of those substances, as that, whereof we deprive them, by the crops produced.

Liebig tells us, that such equal restoration is sufficient to keep up a constant state of fertility; but to INCREASE that fertility, and gain an *increase* of crop, we must provide the soil with a quantity *larger* than we take away. In confirmation of this, he supposes the case of two fields, placed under circumstances *otherwise* similar; the one will be most fruitful on which the plants are enabled to appropriate more easily, and in greater abundance, those contents of the soil which are essential to their growth and development.

He indeed lays it down as one of the *chief principles* of agriculture, "*that those substances which have been removed from a soil, must be completely restored to it; but whether that restoration be effected by means of excrements, ashes or bones, is in a great measure a matter of indifference.*" And he proceeds to prognosticate, "that a time will come when fields will be manured with a solution of glass, (silicate of potash,) with the ashes of burnt straw, and with salts of phosphoric acid, prepared in chemical manufactories, exactly as at present medicines are given for fever, &c. &c."

The planter will derive immense benefit from a knowledge of the peculiar substances essential to the growth and development of his plants, and the definite cause of action in each, as it places at his disposal the actions themselves.

That he may, therefore, the more easily form an acquaintance with this subject, I shall in the first place notice those

particular substances, and by shewing how each is supplied by the different kinds of manure, usually combined under the appellation of compost, endeavour to convey an idea, which may aid them in arriving at a more perfect knowledge of the art.

In treating on the "*influence of soils*," (page 65,) it was stated, that all plants require for their existence, "carbonic acid, water and ammonia," and that the sugar-cane also required, "silicate of potash," &c.

Now in the ashes yielded by the cane, we never fail to detect phosphoric acid in combination with some alkali; from which we may infer, that in common with other members of the same family, phosphoric acid forms a necessary constituent in the growth of the cane.

We will therefore premise, that the sugar-cane requires carbonic acid, water, ammonia, silicate of potash, and phosphoric acid, and proceed to consider each separately, in order to understand fully the mode of supplying them in greater or less abundance, according to will, by artificial means; viz. manuring.

The great source of "carbonic acid" to plants is the atmosphere, from which it is extracted by the leaves and other green parts, as before mentioned. "Ammonia" is also supplied in large quantities by the atmosphere, rain water, and various manures, as will shortly be shewn.

"Silicate of potash," in which combined state it is appropriated by the cane, is obtained by irrigation, mineral earths, ashes of different plants, and from the dung of animals, &c. &c.

Phosphoric acid is often manufactured from bones and supplied to the soil, or the bones being finely pounded, are applied in THAT state, *id est* as phosphate of lime. It is also furnished by the ashes of plants and animal manures.

With this brief notice, we will refer to the manures which follow, as being the most easily obtained by the sugar

planter of India, and glean from that "Table," the properties of each.

Table of Manures, applicable to Cane cultivation.

Ashes from Boiling and Distilling Houses.—Silicate of potash, carbonate of potash, phosphate of lime, soda, magnesia.

Cane Trash, from Trash Houses, &c. &c.—Much the same as the foregoing in its decay, supplies carbonic acid, &c.

Clay.—Metallic oxides, as oxides of iron, alumina, &c.

Cow-dung and Urine.—Silicate of potash and salts of phosphoric acid. Ammoniacal salts, uric acid, and salts of phosphoric acid.

Horse-dung and Urine.—Silicate of potash, and phosphate of magnesia. Ammoniacal salts, uric acid, and salts of phosphoric acid.

Human Fæces and Urine.—Phosphates of lime and magnesia. Ammoniacal salts, uric acid, and salts of phosphoric acid.

Feculences from Still House.—Silicate of potash, phosphoric acid, &c. &c.

Sands.—Silex or silica, carbonate of lime, &c.

Salt.—Chloride of sodium, &c. &c. &c. &c.

Salt-water.—Chloride of sodium, sulphate of soda, sulphate of lime, chloride of potassium and chloride of magnesium.

Marl.—Carbonate of lime, clay, and sand.

Humus or decayed Woody Fibre.—Carbonic acid, &c. &c. &c.

Mud from Rivers and Ponds.—Argillaceous earth and carbonate of lime.

Bones.—Phosphoric acid, phosphates of lime, magnesia, &c.

Each of these substances are within the reach of almost every planter, (with the exception of salt water, which cannot be obtained unless on the Coast,) and the trouble bestowed

on their collection, cannot fail to be most abundantly repaid.

It would be of great advantage to cane culture, were every intelligent planter to make this and such like subjects, matters of study and patient investigation.

The day is fast wearing away, when men can be satisfied with the effect, without entertaining a desire to understand, the cause which produces that effect. Men of sense, blessed with a liberal education, are now numerous in the practical pursuit of agricultural knowledge, and are, day by day, becoming more and more convinced of the necessity that exists for proceeding on reasonable principles, and no longer treat as unfathomable mysteries, subjects which so evidently demand but attentive consideration, to render them clearly understood.

Liebig laments the tardy progression of the art of agriculture, and in a half-despairing style, thus expresses his concern: "But agriculture has hitherto never sought aid from chemical principles, based on the knowledge of those substances which plants extract from the soil on which they grow, and of those restored to the soil by means of manure. The discovery of such principles will be the task of a FUTURE *generation; for what* can be expected from the PRESENT, which recoils, with seeming distrust and aversion, from all the means of assistance offered it by chemistry, and which does not understand the art of making a rational application of chemical discoveries? A future generation, however, will derive incalculable advantages from these means of help."

With an earnest recommendation to my brother planters, to pursue this interesting study in their private practice, I will now leave this digression, and return to my subject.

In the Table of Manures, we commence with the ashes obtained from the "boiling" and "still houses."

This article is to be divided under three heads, as they contain the ashes of three distinct substances.

For the boiling house fire, dry cane trash is used, whereas in the "still house," wood or coal is the general fuel. Now if we allow that two-thirds of the canes crushed by the mill are consumed in the boiling house furnace, we can readily imagine how beneficial to the soil it must be, to restore the ashes resulting therefrom, as they necessarily contain a very large proportion of constituents essential to the growth of the succeeding year's crop. In the furnace, we always find large vitreous masses, consisting almost entirely of "silicate of potash;" this is from the cane trash, and were it pounded and mixed with other manures, (instead of being cast aside as useless,) it would add greatly to their virtue.

The *wood* ashes produced from the "still-house" furnace are greatly to be appreciated for the large supply of alkaline salts, phosphoric acid, &c. &c. which they furnish; it therefore behoves every planter to collect very carefully all the ashes he can, from all possible sources, and put them into the dung reservoir with the other manures.

In cases where coal is used in lieu of wood, the product of the still house fire of course differs. Dr. Thomson informs us, "that good coal, such as that named 'cherry coal,' when burnt, leaves about 10 per cent. of ashes. The combustible portion being a compound of carbon, hydrogen, azote, and oxygen."

These ashes are also to be collected, and applied as the above-mentioned wood ashes.

"Cane trash" is procured from the trash houses, and consists of those portions of the cane, which have been so effectually crushed by the mill, as to crumble into pieces on drying. This not being of much service for fuel, is taken to the cattle-pen as litter, together with all the pieces which may be scattered about the mill-yard, or can be spared by the boiling house.

In the cattle-pen, all this trash is quickly converted into manure, when it should be removed to your reservoir to form compost.*

Cane trash is one of the best manures possible.

" *Clay*"† is pretty generally to be found, I imagine, in most parts of India, and by the estimable properties belonging to certain classes, deserves every attention. It may be used on lands either in its natural state, or after being burnt. The former is of great service when the soil is of a weak, loose, or sandy nature; in strengthening, binding, and enriching the land on which it may be applied. It has also the effect (which is very important in this country) of making the soil more retentive of moisture, and consequently less liable to suffer in seasons of great and continued drought, (see page 65, 3rd No.)

Burnt clay has the power (in proportion to the mineral contained) of absorbing and fixing the ammonia of the atmosphere, as was particularly explained in an extract given at

* It is a cheap and excellent plan to have near your cattle-pens a reservoir for the reception of every species of manure, all which duly mixed together, would form a large and exceedingly valuable compost. The expence of digging such reservoir is scarce worthy of mention, whilst its utility is very great.

† *Clay.*—(Common,) The clays being opaque and non-crystallised bodies, of dull fracture, afford no good principle for determining their species; yet as they are extensively distributed in nature, and are used in many arts, they deserve particular attention. The argillaceous minerals are all sufficiently soft to be scratched by iron: they have a dull or even earthy fracture; they exhale when breathed on a peculiar smell, called argillaceous.—The clays form with water a plastic paste, possessing considerable tenacity, which hardens with heat, so as to strike fire with steel; marls and chalks also soften in water, but thin paste is not tenacious, nor does it acquire a siliceous hardness in the fire.—The affinity of the clays for moisture is manifested by their sticking to the tongue, and by the intense heat necessary to make them perfectly dry. The odour ascribed to clays breathed upon, is due to the oxide of iron mixed with them.—Absolutely pure clays emit *no* smell.—*Ure.*

page 66; and, from the most respectable testimony we have reason to believe, that 150lbs of good burnt clay, spread on a field, will fix as much ammonia in the soil, as 5,000lbs of horses' urine will yield to it, even providing that none of its virtue had escaped. Burnt clay is especially adapted to lands which are subject to a slight annual inundation, or will allow of irrigation; but the most advantageous method of applying it is, when forming your compost in the reservoir. All substances are valuable as manure which can supply plants with nitrogen, and Liebig shews, that plants are supplied with it, in the form of ammonia; 80lbs of ammonia containing 65lbs of nitrogen. It has before been shewn, that ammonia is a volatile alkali, which unless fixed by some mineral oxide, will escape on exposure to the air, as carbonate of ammonia; we will therefore consider the most easy and effectual method of preventing the escape of this valuable article.

Amongst the manures enumerated in the "*Table*," we find urines, &c. particularized as being very rich in ammoniacal salts; but it may not strike a person, how very small a proportion of these salts are in reality preserved to plants, by the usual method of making manure. The idea of fixing them is seldom entertained, or if entertained for a moment, is speedily abandoned, under the old plea of giving too much trouble; whereas, in fact, nothing can be more easily accomplished. Dr. Liebig informs us, "that by strewing our stables from time to time with common gypsum, or burnt clay, the offensive smell is got rid of, and all the ammonia which forms will be retained, in a condition serviceable as manure."

Good ferruginous clay is in a variety of places obtainable, which burnt and broken into very small pieces, can be used for strewing the cattle-pens and stables, and also mixing with the different substances collected together in the reservoir. This will fix the ammonia, and thus counteract

the effects of whatever caustic lime may be contained in the ashes from boiling and still houses.

Cow-dung and *Urine* are supplied in large quantities by the horned cattle, which must be kept on every estate, for the purposes of ploughing, carting canes, and other kinds of work. During crop time, the green cane tops are put into a cattle-pen, for food to the working stock, which being pretty constantly penned up, realize manure very quickly. The pen should be well littered down with dry trash, grass, &c. &c. every second or third day, and once a week be strewed thickly with burnt clay; as the quantity accumulates, it is to be transferred to the reservoir, as before mentioned.

Horse-dung and urine, from stables furnish a very valuable manure, if the strength of its substances be retained, by the methods advised.

Human fæces and urine, are without question the richest of all manures. A repugnance is however manifested by many, even at the bare mention of their being applied to soil as manure; but such weak prejudices and sickly fancies are fast disappearing before the enlightenment of the present age.

France, Germany, and England, amongst European nations, are availing themselves of the example set them in this respect by the Chinese, and are still continuing their researches, with all the enterprise and laudable spirit, so important a subject demands.

Liebig says, that the *excrements* of black cattle, sheep, and horses contain but a very minute portion of nitrogen, that of men, feeding on animal matter, a much greater quantity in proportion, *but* when their food consists principally of bread, potatoes, &c. &c. the composition and properties are pretty similar.

All excrements have in this respect a very variable and relative value, thus those of black cattle and horses are of

great use on soils consisting of lime and sand, which contain *no* silicate of potash and phosphates, whilst their value is much less when applied to soils formed of argillaceous earth, basalt, granite, porphyry, clinkstone, and even mountain lime stone, because all these contain potash in considerable quantities; in such soils, human excrements are extremely beneficial, and increase their fertility in a remarkable degree: they are of course as advantageous for other soils also; but for the manure of those first mentioned, the excrements of other animals are quite indispensable.

We possess only one other source of manure, which acts by its nitrogen besides the fæces of animals; viz. the urine of man and animals. Urine is employed as manure, either in the liquid state or with the fæces which are impregnated with it. It is the urine contained in them, which gives to the solid fæces the property of emitting ammonia; a property which they themselves possess only in a very slight degree. When we examine what substances we add to the soil by supplying it with urine, we find that this liquid contains in solution ammoniacal salts, uric acid, (a substance containing a large quantity of nitrogen,) and salts of phosphoric acid * * * * * *
" with the exception of urea, uric acid contains more nitrogen than any other substance generated by the living organism; it is soluable in water, and can thus be absorbed by the roots of plants, and its nitrogen assimilated in the form of ammonia, and of the oxalate, hydrocyanate, or carbonate of ammonia * * * * * *

In respect to the quantity of nitrogen contained in excrements, 100 parts of the urine of a healthy man are equal to 1300 parts of the fresh dung of a horse, according to the analyses of Macaire and Marcet, and to 600 parts of those of a cow. Hence it is evident, that it would be of much importance to agriculture, if none of the human urine were lost. The powerful effects of urine as a manure

are well known in Flanders, but they are considered invaluable by the Chinese, who are the oldest agricultural people we know. Indeed so much value is attached to the influence of human excrements by these people, that laws of the state forbid that any of them should be thrown away, and reservoirs are placed in every house in which they are collected with the greatest care—no other kind of manure is used for their corn fields * * * * * When it is considered that with every pound of ammonia, which evaporates, a loss of sixty pounds of corn is sustained, and that with every pound of urine a pound of wheat may be produced, the indifference with which these liquid excrements are regarded, is quite incomprehensible.

In another place he (Liebig,) states, that the urine of man is about twice or thrice as rich as that of a cow, and four times that of a horse. In India the planter has it in his power to obtain a large quantity of this description of manure, and I hope that no foolish prejudice, or feeling of shame, will cause its being rejected.

"*Feculences*" from distill-house, consists of the scum from the receivers, the cleanings of the bottoms of cisterns, dunder from still, &c. &c. which should be conveyed to and thrown into the general reservoir.

"*Sands*," which we will class as siliceous and calcareous, exercise an influence corresponding with the nature of the soil to which they are applied. In stiff clay soils they are of peculiar benefit, in preventing the tendency to coalesce and form a hard coherent mass. The sand obtained from rivers is mostly of the siliceous kind, whilst that on the sea coast partakes more of the calcareous, as being in a great degree comprised of very minute fragments of various marine shells.

In making compost, the proper proportions of sand to be used being dependent on the nature of the soil, must devolve entirely on the discrimination of the planter.

"*Salt and Salt-water.*"—Salt itself is perhaps too expensive an article to be used in this country generally. Ten bushels may be allowed to each acre requiring its aid, but on the whole, it can well be dispensed with, considering the abundance of other substances obtainable, by the planter, without such expence.

On seaside estates, however, salt-water furnishes matter which may be turned to good account, and entails no greater cost than that of carriage.

A few casks of it emptied occasionally on the materials collected in the general reservoir, will not fail to produce a favourable effect.

"*Marl*" differs much in its adaptation to lands, fertilising qualities, as also in its colour and general appearance, the better descriptions, being soft and unctuous, of a clear white, or slate blue colour. The constituents of the former are carbonate of lime, with lesser parts alumina, silica and bitumen; of the latter, carbonate of lime, with albumen, iron and bitumen. Dr. Ure states marl to consist of carbonate of lime, clay and sand, the predominance of either in proportion causing it to be classed as calcareous, clayey, or sandy.

It is considered to vary in value, according to the proportionate quantity of lime which it contains. It is a valuable means of increasing the fertility of lands, and amply repays the trouble and expence of carting, &c. &c.

"*Humus,*" or vegetable substances in a state of decay, offers to the planter a most valuable means of enriching his land. A vast quantity of vegetable matter can in most places throughout India be easily collected at a very insignificant cost, and the increased produce which will result from its proper use and application, will incontestibly prove its fertilising virtues.*

* Humus supplies young plants with nourishment by the roots, until their leaves are matured sufficiently to act as exterior organs of nutrition; its quantity heightens the fertility of a soil by yielding more

"*Mud*" obtained from rivers, creeks, ponds, &c. usually abounds in mineral and vegetable constituents of the highest order, and is in supply the most cheap, plentiful, and easily procured manure of any yet enumerated, whilst it induces to fertility, to a degree, that renders it entitled to our especial notice.

It varies in its component parts and consequent value, according to the place from which it is taken. Thrown into the reservoir with the others, or laid over the fields and ploughed in, is the proper mode of using it; perhaps the latter might prove the less expensive method, although the former would be preferable in point of the increased richness which it would gain, from being intimately mixed up with the several substances collected in the reservoir.

Another source of mud is by inundation, or irrigation. When a river per force breaks through its embankments and inundates the surrounding country, no one can foretel the good or evil which may accrue to the soil. It may leave a fine rich deposit of mud, or it may overwhelm and cast out of cultivation whole tracts of country by the immense quantity of sand which it leaves. It is therefore generally either a choice blessing, or else a curse most dire and destructive. But where lands can be inundated by *artificial* means, or, at will, a sure and extremely beneficial effect must follow. This subject will be more particularly treated of under the head of *irrigation.*

nourishment in this first period of growth, and consequently by increasing the number of organs of atmospheric nutrition.—*Liebig, page* 122.

Humus acts in the same manner in a soil permeable to air as in the air itself; it is a continued source of carbonic acid, which it emits very slowly. An atmosphere of carbonic acid, formed at the expence of the oxygen of the air, surrounds every particle of decayiny humus. The cultivation of land, by tilling and loosening the soil, causes a free and unobstructed access of air. An atmosphere of carbonic acid is, therefore, contained in every fertile soil, and is the first and most important food for the young plants which grow in it.—*Liebig, page* 47.

"*Bones*" for the purposes of manure are becoming of daily increasing importance, vast quantities being sent even to the West Indies from England, under the name of bone manure or compost. On sugar estates it is used to a large extent, and with the most happy effect. When crushed and pounded finely, bone dust is either applied at once to the soil, or treated with sulphuric acid, and thus presented to the soil as phosphoric acid. To prove the great value of this manure, Dr. Liebig informs us, "that 40lbs of bone dust applied to an acre of land, is sufficient to supply three crops of wheat, clover, potatoes, turnips, &c. with phosphates. But the form in which they are restored to a soil, does not appear to be a matter of indifference. For the more finely the bones are reduced to powder, and the more intimately they are mixed with the soil, the more easily are they assimilated."

To suit the East Indian sugar planter, I know no better plan, for cheapness and simplicity, than the following. Build one or two simple kilns, either of mud, brick or stone, (near some old tope or patch of tree jungle, which when cut and dry, saves the expence of carting the logs,) and lay the bones and wood in alternate layers, taking care that the logs be thick, and the kiln well ventilated. When properly burnt, the contents of the kiln can be passed through sieves and the coarser portions resulting placed in a circular trough, and subjected to the crushing process of a large roller, which may be drawn round by one, two, or more bullocks, until the bones are reduced to powder. Many persons may ask, how are bones to be procured in India. In answer to which I must reply, in the most easy and abundant manner you can wish. The planter has only to make known to the various chumars and other low castes, residing in his neighbourhood, that he requires bones of cattle, horses, &c. to be brought to him, at the rate of so many pice per basket or maund; and may rest assured, he will not be kept long

without a supply. In parts bordering on pasture lands, in the Terai, &c. &c. thousands and thousands of maunds may be procured either for use, or exportation to other parts.

"*Charcoal*" though not mentioned in the list of manures given, is, however, of too much importance to be passed over unnoticed. As a manure it cannot fail to be highly esteemed, on account of its singularly valuable properties, which appear to consist chiefly in the power it possesses of condensing gases within its pores, as carbonic acid and ammonia.

Liebig supplies us with the following information: "Plants thrive in powdered charcoal, and may be brought to blossom and bear fruit if exposed to the influence of the rain and the atmosphere; the charcoal may be previously heated to redness. Charcoal is the most "*indifferent*" and most unchangeable substance known; it may be kept for centuries without change, and is therefore not subject to decomposition. The only substances which it can yield to plants are some salts, which it contains, amongst which is silicate of potash. It is known, however, to possess the power of condensing gases within it pores, and particularly carbonic acid; and it is by this power that the roots of plants are supplied in charcoal, exactly as in humus, with an atmosphere of carbonic acid and air, which is renewed as quickly as it is abstracted." Again, when speaking of the absorption of ammonia by clay or ferruginous oxides, he says, "Powdered charcoal possesses a similar action, but surpasses all other substances in the power which it possesses of condensing ammonia within its pores, particularly when it has been heated to redness. Charcoal absorbs 90 times its volume of ammoniacal gas, which may be again separated by simply moistening it with water, (De Saussure.) Decayed wood approaches very nearly to charcoal in this power, &c. &c."

I am aware that in India planters will have great trouble in procuring a supply adequate to the quantity requisite in a large cultivation, unless they happen to be located near some

tract of jungle land. Whilst I was residing in the jungles of Goruckpore, I could at any time command a supply, to any extent, at the rate of seven rupees the hundred maunds, contract work. If situated at a distance, *carriage*, whether land or water, would form an additional item of expence, as a matter of course; consequently the greater or less distance which it would require to be conveyed, would determine, in a great measure, the propriety of using it as a manure. Amongst other methods of manuring lands, it will be interesting and useful to the planter to be informed of a system much practised in Jamaica, usually denominated "*fly-penning.*" A strong pen is constructed, by placing mortice posts, about 12 feet asunder, with long bamboo rails running through them, firmly bound with rope, bark, or string, so as to enclose about half an acre at a time. In this pen, a large quantity of grass, cane tops and other provender are usually thrown during the day, and at night the cattle are turned in. Supposing that there are 200 head of stock so enclosed in each pen for five nights, the planter would reckon that he gives his land, (at the rate of) 2000 head of cattle per acre, which may be deemed liberal manuring. As the first half acre is manured, the next half acre is enclosed in the same way, by removing three sides of the pen, and this continues progressively until the field is entirely gone through. The soil is then turned up for the reception of canes, either by digging with the hoe, or by ploughing—and at once planted. Fly-penning, is more or less to be appreciated according to the nature of the ground and quality of soil.

It is frequently resorted to on old rattoon cane fields, and generally answers admirably; the method is as follows: Immediately after cutting, the field is fly-penned, at the rate of not more than 1,000 head to the acre, and as the young

sprouts from the old roots begin to appear, labourers are employed in turning trash, and supplying fresh plants in those places where the roots have decayed.

I have known a field thus treated, (or as it is termed in Jamaica, "*penned on the stock*,") yield canes almost as fine and rich as *plants*.

Before quitting the subject of manuring lands, I must beg to call the particular attention of my brother planters to a few remarks which I here submit to their notice.

It is an oft-repeated saying in India, that the fertility of Bengal exceeds every thing; that nothing can surpass it. Indeed, there are *those* who do not hesitate to say, that it is superior to the soil of the West India islands. These most incorrect assertions have had the effect, in many instances, of influencing the ideas of planters on the subject of manuring, and the course they have been led to adopt in consequence requires only a slight investigation, to prove it based on error. I will instance the case of an indigo planter, who making yearly but two hundred maunds of indigo, keeps perhaps 5000 pucka begahs constantly on rent, the great part of which is comprised of detached pieces, scattered hither and thither, amongst the different villages in his neighbourhood. Two thousand begahs may be in cultivation, whilst the remaining 3000 are lying fallow; whereas if manure were judiciously applied to such 2000 begahs, the other 3000 might very well be dispensed with.

The expense of collecting and applying manure would in no case, I imagine, amount to a fifth of the sum required to cover the extra rent, carriage, &c. &c. entailed by the present system.

But, no! manuring the rich lands of Bengal is by far too monstrous a notion, to be easily digested. Oh, says one,

what need have we to manure, when we can do without it? Even if our land does fail in its produce, there is plenty more, we can get, whilst it is recovering itself! Your lands in the West Indies wont answer without constant manuring, but ours will continue year after year to give fine crops." All this high sounding praise tends to bewilder a person when he couples it with the continual complaints which are now openly made, when speaking of sugar cane cultivation, especially Otaheite, &c. It never will answer, says one, we cannot compete with the natives. Cane won't rattoon, as I hear they do in the West Indies, says another.

The Otaheite and other large canes degenerate very much in India, which no one will deny. I am afraid they won't do here, exclaims, a third. There is *something* in the soil, climate or seasons. I don't know what it is, adds a fourth, but 'tis very certain, that we can never hope to get such large returns as you do in the West Indies, indeed not half or even a fourth; there is something wanting in the soil, depend on it.

Now with all due deference to superior judgment, I confess my entire acquiescence with the last mentioned opinion; viz. "that there" is a "*something*" wanting; and that *that something* consists in a want of a rational *system of manuring*, I am well assured can be fully demonstrated.

Let us glance at the West Indies, and mark the magnificent crops that are there secured, ranging from two to three tons of fine sugar; and ask ourselves the question, could such crops be realized year after year, without the aid of a proportionate quantity of manure? Can we expect to find a soil sufficiently powerful to continue a supply of such rich description, unaided by an equal restoration? and *reason* herself will answer, "*No, impossible!!*"

Nature is abundantly grateful in her products, she seldom fails to repay our care with usurious interest; nourish *her*, and she will prove a faithful friend; but, expect impossibilities, and we'll justly reap disappointment.

In concluding this article, I will only add, that by manuring their lands when requisite, my brother planters may with confidence expect an abundant crop of canes, which will not fail him in rattooning

(To be continued.)

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. VI.—1843.—Vol. II.

QUERIES AND REPLIES CONCERNING MANURES EMPLOYED BY CHINESE AGRICULTURISTS.

Forwarded from Chusan, by A. Shanks, Esq., M. D., *H. M. 55th Regiment.*

Queries drawn up by Lyon Playfair, *Ph. D., for circulation among the Chinese and Indian Farmers.*

[Reprinted from the Journal of the Society, for October, 1842.]

1. Is much value attached to the urine of animals as a manure, and in what state is it applied ? What animal is considered to afford the best urine for manure, and to what kind of crops is it applied ?

3. Is much night soil (human fæces) used for the purposes of manure ? How is it prepared for this purpose, and to what extent is it applied per acre ? What kinds of plants are found to be most benefited by it ?

4. State particularly, how the dung reservoirs are made, (if protected from evaporation, &c. &c.) and what substances are usually thrown into them.

5. State whether animal manures are applied fresh, or in a state of putrefaction.

6. State what mineral manures are used, such as lime, gypsum, saltpetre, &c. &c. specifying the quantities per acre, the crops to which they are applied, and the manner of their application.

7. Is the land ever left fallow, and if so, how often in twenty years?

8. Is there any rule for the rotation of crops; that is, is there any succession of crops which are found to grow best one after the other?

9. Are the ashes of burnt plants or wood, used for manures? If so, what ashes are preferred, and to what crops are they furnished?

10. Is flesh or blood held in esteem as manure?

11. Are the ground bones of animals used as manure, or are they thought much of?

12. Is saltpetre ever used as manure; if so, to what kinds of land is it applied? Is it used before sowing, along with seed, or after the blade is up?

13. Is much value attached to the dung of domestic animals, such as the cow, horse, sheep, elephant, goats, &c. and which animal furnishes the best manure? Are the excrements of snakes used or valued?

14. Is common salt used much as a manure? If so, to what crops, and to what kind of lands?

15. What kinds of manure are found to answer best for bamboos; what for rice; what for Indian corn, &c.?

16. Is burned clay ever used as a manure?

17. To London and other places in England, perfect little Oak trees of 1½ foot high, have been sent from China. How do the Chinese manage to make these trees dwarfs.

18. Can corn be grown for three years in succession on any land, or for how many years can crops of corn plants be obtained in succession?

19. State all the different substances usually employed as manure, and all those you have heard have been employed.

20. Is it true that few or no weeds are to be seen in the corn fields of China, and do the Chinese ever use animal manures (not human) for their corn fields?

21. Is it customary to apply the manure on the lands, or are the plants themselves rather manured?

22. Is it the case that the seeds of plants are often steeped in urine before being planted?

23. Is it at all customary to burn the straw of plants, and strew the ashes on the field, or to return it unburnt to the soil.

24. State any details about manures and soils, which you may think interesting, although questions are not here asked about them.

QUERIES INTENDED TO BE SENT TO CHINA.

1. Ascertain how night soil is prepared by the Chinese as a manure, mixed up in the cakes, as it is sold. To be put in a bottle, well corked and properly labelled.

2. Any soil eminent for great fertility, well corked up, would (a few of them) be valuable.

3. Any artificial manures, sold as such, would be exceedingly valuable.

This to be circulated for the purpose of being translated into Chinese, as that people are the best Agriculturists in the world. It would be very interesting to have the original answer sent in, transmitted to this country, along with the translation; I mean only as a curiosity. Any agricultural curiosities would be highly acceptable. If these questions were properly answered in various districts, they would be a valuable addition to our knowledge.

[The particular attention of Planters, Mofussil Members, and all who are so situated as to be able to afford information on the important subject of manures, is directed to the above queries. They have been

drawn up by Dr. Lyon Playfair, the translator of Liebig's '*Organic Chemistry in its Applications to Agriculture, &c.*,' and likewise an Honorary Member of the Royal Agricultural Society of England, which distinguished honour was recently conferred upon him, for his eminent scientific acquirements, and the great amount of good likely to result from his application of them to the investigation of the more obscure and little known parts of Agricultural Chemistry. It has been justly remarked by the most recent and distinguished authority on the subject, that "Agriculture has hitherto never sought aid from chemical principles, based on the knowledge of those substances which plants extract from the soil on which they grow, and of those restored to the soil by means of manure. The discovery of such principles will be the task of a future generation, for what can be expected from the present, which recoils with seeming disgust and aversion from all the means of assistance offered it by chemistry, and which does not understand the art of making a rational application of chemical discoveries?" Let us indulge the hope, that the Agricultural Society of India, will ere long cease to labour under this severe, but just censure. Let each member come forward with his item, however apparently unimportant it may appear to be, of sound practical information, founded on facts and the results of his own experience: let the intelligence communicated be confined as much as possible to such facts, and deal as little as possible in unprofitable speculation: and in the course of a very short time, a body of important observations will be collected, which will tend alike to the advance of Agriculture in India, the honour and prosperity of the Society, and the credit of the individuals communicating them. Such were the great objects for which the Society was founded, and such are the ends that may easily be attained, by a little well directed zeal, energy, and observation.]—Ed.

Replies to the foregoing Queries, by Assistant Surgeon A. Grant, *H. C. S. attached to H. M.'s* 55*th Regiment at Chusan. (Addressed to the Bengal Agricultural Society.)*

1. I have not observed the Chinese make use of any other than human urine, this however is highly valued, carefully stored up, and is I believe applied to *all* crops at some stage of their growth. It is always used diluted with water, and mixed up with night soil that has undergone fermentation.

3. Night soil holds the same relative importance in Chinese agriculture, that farm-yard manure does in European, and the whole population of this country evince how much they value it by their universal carefulness of it. Its preparation requires little trouble, and the extent to which it is applied per acre depends upon no fixed rule, but upon the necessities of the soil, and the individual judgment of the farmer. It is always applied in the form of irrigation, mixed up with urine and water. The plants most benefited by it are wheat, rice, and vegetables cultivated for their leaves, such as cabbage, and a species of turnip much used among the natives, and to which it gives a very rich foliage.

4. They consist for the most part of large earthen jars placed in the vicinity of the houses, by the road sides, and near to the fields. They are seldom covered unless for the protection of visitors. To prevent evaporation, a quantity of straw is thrown in, this floats upon the surface, and as fermentation goes on, the particles that rise up, get entangled in the meshes of the straw, and form a crust that effectually preserves the liquid. In some places I have observed square pits dug out in clay soil, and used as dung reservoirs, but more commonly for cow-dung; when used for night soil, they are lined with slabs of stone, and the seams closed up with cement; into these every sort of garbage is thrown, and when filled, an old mat is thrown over the whole.

5. Generally speaking, the Chinese farmer applies all animal manures in a state of putrefaction, and he uses every appliance to promote this process.

6. I have only observed the lime from old buildings made use of, and this was in the preparation of seed beds. The lime being mixed up with a quantity of wood ashes is laid upon the finely triturated soil, and over this again, a layer of cow-dung; the soil for which this is used is a cold clay, and the process shews, that the Chinese are not ignorant of the stimulating properties of lime. The supply of lime is derived

from the burning of shells which are not very plentiful, and this may be a cause of the limited use of lime. Saltpetre being an article of import, is too expensive for the purposes of agriculture.

7. The land is never fallow in our acceptation of the term. This arises as much from the necessities as from the social condition of the people. The Chinese are not partial to bullock's flesh, and keep only a supply sufficient to work the soil; neither do they keep horses for draught, nor for pleasure, all carriage being conveyed by water, or on the backs of coolies; for this reason pasture land is not in repute. The longest period of rest that the land enjoys, is between the months of November and April; it may then lie simply in the state in which it remained after the cutting of the last crop; secondly, it may be ploughed over in autumn, and left exposed to the air throughout the winter; thirdly, it may be so ploughed and afterwards sown in beds with trefoil or lupine; and lastly, it may be thrown into ridges about eight feet high, two feet broad, and three feet apart; these ridges are sown with trefoil, which is ploughed in spring just as the flower is beginning to open; it attains a height of 18 inches, has a foliage as rich as our best clovers, and is considered to take little from the soil, and therefore when returned, to enrich it greatly. The following is generally the economy of a small farm during the winter months: one or two fields are flooded, and left unploughed; another is ploughed, and remains exposed to the air; a third is sown with trefoil; a fourth with buck wheat; a fifth with mustard; and a sixth is devoted to the cultivation of vegetables. This rotation is changed annually according to circumstances, but all are made available for a crop in spring.

8. I do not think that there are any fixed rules for the rotation of crops, for rice is grown year after year upon the same ground, and two or three crops of vegetables one after the other in the same year, and for a succession of years. It

is not unusual also to see growing on the same pieces of ground, two crops of vegetables, which by arriving at maturity at different periods, are each brought to as great perfection as if only one kind had been cultivated. This double exhaustion of the soil is counteracted by careful irrigation and manuring.

9. Wood ashes are extensively used, they are not prepared solely for the purposes of Agriculture, but with the wonted carefulness of the Chinese, are made secondary to another use. In these districts, all the fuel is derived from the long grasses that grow on the sides of the hills, from a species of stunted fir, and from various kinds of brushwood: these are burned in the kitchen, and the fire-places being constructed upon the same plan as our furnaces, the whole of the ash is preserved.

This ash, I presume, contains a considerable quantity of alkali, and the natives are not ignorant of its properties.

It is used in the raising of seed, but its more extensive application is after the blade is up; it is then applied to the trefoil when of very young growth, and also to several kinds of vegetables.

10. The use of either has not come under my observation, on the contrary it is very common to see dogs thrown into the canals, and cats hanging from trees, wasting their substance on the air.

11. I have not seen them used, but I understand that the Chinese do often recover a piece of very cold land by means of bone ashes.

12. Not that I am aware of, but a friend informs me, that he has seen it applied to vegetables after the blade is up.

13. The Chinese attach great value to the dung of all domestic animals, and we observe their small stock always carefully stored by. The accumulated proceeds of the cotter's single cow or buffaloe, are generally expended upon the rice fields that have not been sown with trefoil; it is applied either before the first ploughing, or immediately previous to the land

undergoing the second ploughing. It is also applied between the rows of vegetables, and upon trefoil after the blade is up. I have observed some farmers bestow great labour upon their dung heaps; turning them frequently over, mixing them with soil, and putting on a layer of wood ashes betwixt every two layers of dung, so that when exposed to heat and moisture fermentation took place, and with it a perfect incorporation of the mass.

14. The high price of common salt, which is a government monopoly, precludes its use in agriculture.

15. In the cultivation of bamboos upon this island, there seems little other notice taken of them than watering the young plants; a sandy soil is preferred, and on an elevation. They are said not to thrive with a northern exposure, and here we always see them occupying the southern and eastern face of the hills, while the more hardy fir occupies the northern.

For rice, the best is the *liquid manure*, (human fæces, urine, and water,) and the *green manure* (trefoil or lupine,) ploughed in. The farm yard manure (cows, pigs, and horse-dung) occupies of necessity the third place in Chinese agriculture, and with all other manures, is never used *instead* of the liquid, and green manures, but only to aid them.

16. I have seen old bricks pounded and thrown upon seed beds.

17. I possess no accurate information on this subject. I may however mention, that the growth of the beautiful ever-greens I have seen in the gardens of rich Chinese, seemed to be checked by these being planted in pots, and their branches subjected to severe twisting and training by means of twine. This process necessarily checked nutrition, and the fanciful shapes the trees were made to assume, were retained with little trouble afterwards.

18. I believe there is no limit to the growth of corn in the rich plains of China, and I have no doubt, that two crops

of rice have been got from many soils year after year from time immemorial.

19. Those I have seen employed are human fæces and urine; cow's, pig's, and goat's-dung, the cleaning of sewers and canals, wood ashes and old lime, trefoil and lupine ploughed in. Those I have heard of are, saltpetre, feathers, horns, and bones reduced to powder, hair from the barbers' shops, offals from the butchers, soot, oil cakes, lime, fish, crabs, and seaweed.

20. It is a truth, that all who have been in China will assent to, and arises from the industry of the farmers, and the system of drill cultivation which universally prevails. The cultivator's whole energies are devoted to a small spot, and upon this he must either live or die; there are no large and rich farmers here. All kinds of grain and vegetables are raised in beds, and afterwards transplanted. The ground before receiving the young plants is generally twice ploughed, and then divided into beds or ridges; in this process the clods are broken up, and the soil finely pulverized; when the plants have taken root and attained some height, the earth is hoed up around them, and the liquid manure applied to the plant itself, and in greater quantity to such as appear weakly. The same process is twice repeated, until the plants attain such a size that they cover the soil, and prevent the growth of weeds.

The advantages of this system are observable in a larger grain and leaf; it also secures the crop being planted at a depth favourable to growth and a simultaneous ripening; there is no unequal distribution of seed, and no tufts excluding both air and moisture, by the same reason a blank is as rarely to be seen as a weed in the corn-fields of China.

21. Both, and therein consists the excellence of the system; the farmer knows that a weakly plant can never turn out well. If therefore a field shews evidence of exhaustion in its rising crop, the liquid manure is more plentifully appli-

ed to it, and the practice of storing up the night soil for such exigencies is always attended to, thus a failure of crop is almost impossible.

22. I have seen it recorded, but never adopted. In the cultivation of rice a practice much similar prevails, and is as follows: Great labour is first bestowed in the preparation of the seed beds, the land undergoes three several ploughings, it is then harrowed, and after being flooded, is worked into a fine mud—this is said greatly to fertilize it; liquid manure containing much urine is next freely applied, and the surface of the bed made almost as smooth and level as a billiard table, the mud having subsided, about an inch deep of water (holding urine in solution) remains on the surface, and precautions are taken to keep it at this level; the rice advanced in germination by being previously steeped in water is now thrown in, the eye of the labourer directing its equal distribution, and here it soon takes root, and springs into active life.

23. Trefoil and lupine are ploughed in unburnt, but all kinds of grasses and brushwood are burned, and the ash applied to the ground; but more commonly about the plant itself; occasionally, we observe rank grass burned down to procure a young crop, this however is rare at Chusan.

24. My whole information respecting manures is embodied in the foregoing answers, and I shall here recapitulate some of their advantages. The manure is applied both to the soil itself and to the plant, such plants as are weakly are thus more generously supplied: the liquid form of manure also combines the advantages of irrigation, and if due care be taken, a failure of crop even in a dry season becomes almost impossible; the good effects of its application are seen in the leaves of wheat and turnips becoming soon afterwards of a deeper green colour, and stronger.

The green manure gives to the soil a large quantity of vegetable matter, the decomposition of which affords nitric acid and ammonia, and a due portion of salt is supplied by the

wood ash, forming as a whole, a great source of fertility at a trifling expense of labour, and at a season of the year when the husbandman is least engaged. This custom which prevailed among the ancient Romans, who ploughed in the lucerne as the Tuscans still do the white lupine, and the Germans the borage, dates its origin among the Chinese from time immemorial.

Respecting soils, I am not aware of any notable for great fertility. It is true, that the vallies of China possess a fertile soil, but they are only made highly fertile by artificial means. These are; *1st*, the manures above alluded to; *2nd*, the labour bestowed upon the ground in ploughing, harrowing, covering it with water, and working it into mud, or when it is raised into beds, assiduously pulverizing it by means of a heavy hoe; *3rd*, a plentiful supply of river water from the canals that everywhere intersect the vallies.

25. *Agricultural Curiosities.*—Of these I have seen few in China. It has been well observed, that the agricultural implements of the Chinese are formed rather to direct labour than to abridge it. Some of their machines for raising water in irrigating, are very ingenious. The most common is a wooden chain pump that runs upon two cylinders, and is worked by the hand. A model shall be sent to the Society. Their fanners are well known, and were no doubt introduced by the Dutch into Europe. Their plough drawn by one bullock and buffaloe, is simple but efficient, has only one handle, and is often without a coulter. Heavy rakes with one, two, and three prongs, and a harrow which is nothing but a huge rake with a row of twelve iron teeth, and an upright handle on which the labourer directing it rests his weight, form the stock of instruments. A few large earthen pots as the recipients, and two wooden buckets and a ladle for the distribution of the liquid manure, complete the list. One machine I have omitted; it consists of a strong wooden frame with two cross bars, into which are fixed horizontally

two rows of strong concave knifes, this forms a kind of harrow for cutting up the trefoil. The field is flooded, a bullock yoked to the machine, and the driver standing upon it, it is urged through the soil in all directions.

Remarks.—What strikes the observer most forcibly is, the universality *of this system of agriculture; it is the same in* the smallest corner of this island as in the broad plains of the Tang-tse-kiang, and China is in fact one great garden—another Eden. The great emperor, who himself annually holds the plough, points out the importance of the careful cultivation of the soil, and with the people, it is viewed as the most honorable of occupations; thus by the encouragement held out to the agriculturist, and by the improvement of her natural advantages for the formation of canals, China has outstripped every other Asiatic nation, both in wealth and population, and that population enjoying too a high degree of comfort, if I can judge from nearly two years' observation over an extensive tract of country. In simplicity and productiveness, the system is unequalled, and it is certainly the one best suited to the insulated policy of the government, and the social condition of an immense and overgrown population, whom it both feeds and employs. I consider it therefore highly deserving the attention of either the Government, or the Society, to institute a minute inquiry into what constitutes the superiority of the Chinese system of agriculture, and how far it is fitted for introduction into Europe, or the Continent of India, consistent with the climate and soil of both, and the habits and prejudices of the cultivators. The war now happily terminated, has opened the field of inquiry by having destroyed the jealousy that formerly prevented our making observations, and the result might turn out very important to the interests of India, the greater portion of which approximates very nearly in soil and climate to that of China. The ancient rulers of the country acted upon the principle, that the formation of canals, and

holding out encouragement to agricultural industry, were the surest means of advancing and consolidating their empire; it *has* proved eminently successful, and a useful lesson might be borrowed from the example.

As far as I am capable of judging, the system is not much adapted to the large scale of farming in England, unless in one very important branch of it, the raising of turnips (and perhaps wheat) to which the liquid manure would be a valuable application. It is the small farmers, or cotters, who would benefit most by it, and they are a class whose interests, compared with their importance, have been as yet little studied.

Chusan, 21st April, 1843

Replies to the foregoing Queries. By G. TRADESCANT LAY, *Esq., Interpreter to H. M. Spec. Mission.*

1. The Chinese are not much addicted to cattle-grazing, nor have I seen any out-houses so contrived as to secure the stale of animals. They however use it when at hand without any discrimination; at least this is the answer given by a Chinese to the inquiry.

At Woosung, the excrements of neat swine are applied in a dilute state to beans, after they are sown in lines upon the unstoned ground. The seeds of medick are mingled with this manure, so that the beans spring up amidst a layer. A dressing of wood-ashes kneaded with a little earth is laid over the same lines, that the crop might have its dues of salts and ammonia at the same time. The deductions of chemical philosophy have had less share in teaching the Chinese this practice than economy, which leads them to give back to the soil the substances most obviously derived from it.

3. In China this is the staple manure. It is collected in large earthen vessels, which are seldom covered, and then

only, partially, for decency sake, a virtue not much affected here. It is usually applied in a state of decomposition, and always very freely mingled with water. The quantity "applied per acre" is not limited by theory, but depends upon the *means* and individual judgment of the farmer.

4. "Dung reservoirs." In the middle provinces there are earthen jars, manufactured near Loo-chow, with a narrow base and a wide mouth. In the south, the dung reservoirs are pits rendered water-tight by means of lime and oil spread over their surfaces.

Extraneous "substances" are not commonly thrown into these receptacles.

Much store is set by human urine in the province of Ché-keang, hence in the fields as well as in the immediate neighbourhood of dwellings, pots are set for the accommodation of travellers.

5. Manures are seldom applied "fresh," as it would not be convenient to do so. The habit of storing up manures necessarily renders them putrid.

6. I have not seen "lime," "gypsum," or "saltpetre" used for fertilising the soil, and I am told, that they are not employed for that purpose.

7. "Fallows" have not fallen within my observation. In the culture of rice, there is however a method that seems to possess an advantage to which the practice of fallowing has preferred its claims, namely, that of exposing the soil to the influences of the atmosphere. In the interval between the earing-time and the setting out of the rice, the land is thrown up into ridges, which are about two feet in breadth, and nearly that distance apart from each other. The ridges are planted with medick in lines, which are turned in when the necessary preparation is made for transplanting the rice.

Wheat lands often get a rest during the same period, but in this case they are not wrought, but lie with the stubble upon them.

8. The rotation of crops is, as far as I have seen, very simple. In Chusan, wheat alternates with buck wheat, whereof the seeds are useful in some kinds of cookery; but in good soil, wheat may be grown year after year without exhausting the energies, as these are supplied by an assiduous attention to manure.

Buck wheat is presumed to draw but little from the soil, and medick to give back more than it takes; hence the latter is much cultivated.

9. The "ashes" of burnt brushwood, grass, and the branches of the pine are used without reference to their original. In the composition of fuel, grasses, chiefly *Andropogon* and kindred genera, are the most abundant. These ashes are laid up in small sheds erected for the purpose, and by the addition of little mould formed into clods and grains for the convenience of application. The *rejectamenta* of the table are sometimes thrown into these buildings.

10. "Flesh and blood" are generally consumed by the Chinese themselves. A dead dog or a dead cat is allowed to lie and perfume the air for the space of a furlong, but no one thinks of throwing the carcase into a dung reservoir.

In a little Chinese work now open before me, there is a recipe for making the "kumkwat," or kin-kene, bear fruit. It consists in taking a large rat, steeping it in a dung jar, and then after cutting it to pieces, applying it to the roots of the tree in a trench prepared for the purpose. The theory of this process is—each piece produces a maggot, each maggot a root, and each root a fruit; mud is spread over the sections.

11. The "ground bones of animals" are not used in this part of China.

The putrid remains of sea crab are occasionally used, but these are not always within reach.

13. "Much value is attached" to the dung of domestic animals, as we have seen in the instance of cow-dung. Litter is spread over the soil between cabbage plants, in patches,

on the slopes of hills. This expedient protects the mould from cold and evaporation, and fertilises it at the same time.

14 "Common salt" is too expensive, owing to taxation, to be employed in agricultural operations.

15. "Manure for bamboos," &c.

In cultivating bamboo shoots for the table, an old practice is to cut down the stems of all the original bamboos within three or four inches of the root, and then to fill the hollow of the stumps with brimstone. The ascendant roots should be turned down, and the whole tuft covered with earth.

A composition of night soil, urine and water, well mixed together, answers best for wheat, rice, and I believe also for Indian corn.

The excellence of this manure, so far as it depends upon the preparative measures, consists, apparently in the following particulars :—

1. It is matured by putrefaction.
2. It is dissolved in water or urine, or both.
3. It is diffused in equal proportions over the soil.
4. It is applied to the surface, and consequently to the earth in immediate contact with the roots.

The ordinary implements are two or more very large buckets, and a spoon or ladle.

The ease with which the husbandman carries two of these large vessels filled with the appropriate ingredient, and the dexterity with which he wields the ladle in even allotment, are the results of use and experience.

16. I am not aware that "burnt clay" is ever used. Fresh clay of a ferruginous colour, obtained from ravines and the rifted sides of hills, is nibbled into a powder, and then rolled into clods or grains. These grains are laid round the roots of the medick, while the field is in training for a future crop. An unpoisoned soil may be the advantage here sought.

17. *Dwarf Trees.*—The process is very simple. A branch of a large tree which for size, form, and sightlines, best pleases

the eye, is selected. The bark is pared off to the length of six inches where the intended section is to be made. The bared ring is surrounded by a plastering of soil and mud, which is allowed to remain till the bark has shot roots into it. When this has taken place, the branch and ball are removed into a pot, where the former will flourish, as if no change had passed upon it.

18. "Corn," such as wheat and rice, can be grown for three or any other number of years, if the land be good and the manure abundant.

19. The "substances usually employed as a manure" are night-soil, human urine, wood and straw ashes, clay, crabs, and the testa of beans pressed out in the manipulation of bean curds. Mud, fished up from the bottom of canals and pools, is poured into the furrows to supply humus for rice.

20. It is true that "few or no weeds are to be seen in the Corn fields of China." This happy exemption is to be ascribed neither to soil, climate, or peculiarities of manure, but to the watchfulness of the peasant, whose assiduous labour always keeps the grain in the ascendant, and prevents the intrusive weeds from gaining head. The rice after it is transplanted, undergoes three several processes of cleansing. In the first, the panic and kindred grasses, ever ready to spring up in the rich soil, are plucked up before they have time to injure the corn or propagate themselves. In the second and third, the soil is broken by a very heavy hoe, which is not *drawn* as with us, but *struck* into the ground.

21. "The plants are manured" as well as the ground, in the case of cabbages and other culinary herbs of the same natural family, for a ladle-full is poured on the top of each plant while growing.

In Wheat.—The land is turned up by means of a three-pronged fork, struck into the ground like a mattock. On the unstirred portion the seed is sown, and afterwards covered by the broken clods. As soon as the clods are subdued

and the face made even, liquid manure is poured over the whole, so equally, that no part is unvisited by the artificial observer.

22. It is not customary here "to steep the seeds of plants in urine." Rice is steeped in water before it is grown. A basket is set into a slough of water, containing the seed presently to be spread abroad. Fermentation thus promoted, assists in the germination of the grain.

23. It is "not customary to burn straw" or haulm on the field where it has stood, since the former is valuable as a fuel in the kitchen, and the latter is inconsiderable, as the stem or culm is cut close to the ground. The root is allowed to remain.

24. I hope to have other "details" by and bye, when I have turned over the agricultural books, translated these queries more fully, and found a quiet hermitage in China itself.

1, 2 and 3: Specimens of soils, dried manures, bean cakes, &c. shall be sent to the Royal Institution of London, by some convenient mode of transmission.

I have translated most of these queries into Chinese, and entered and adapted them, as mental leisure serves, to the compass of Chinese information.

Suggestions.—Reservoirs should be formed in the middle of our estates, for the reception of night soil and human urine, after the Chinese model. After they have lain there for some time, they should be mixed with water and be poured on our wheats, barleys, &c. immediately after they are planted. On our turnip plants, a solution in the ratio of one of manure to 5,-10 of water should be poured, especially in dry summers. When the field is near the highway, litter might be strewed upon the surface after the plants are set out. If these two expedients were resorted to, especially the former, a failure of crop would be impossible.

Replies to the foregoing Queries. By the Rev. C. Gutzlaff.

1. None but human, and this is mixed up with the fæces, and in a liquid state thrown upon vegetables, or any plant separately, nearly in the same manner as if they wanted to irrigate them; this is done twice or thrice, and as far as my observation goes, promotes the growth of cabbage to a very great degree.

3. Extensively, it is kept in pots and mixed up with some vegetable matter and then allowed to ferment, and stands in that state often for one or two years before it is used. Its application is general to all rice as well as vegetable crops, but used under modification. In the South, they reduce it by a very lengthy process to cakes, and it is then pulverised and mixed with the soil; at Chusan I never saw this process.

4. They consist of large earthenware pots, without protection from the weather, and the substance thrown in is mere garbage.

5. The latter.

6. None to my knowledge here.

7. No, but a great part remains fallow during the winter, after having first been ploughed, and by the more industrious peasant sown in ridges with a kind of clover, which on the ensuing spring is mixed up with the soil, after bearing blossom; and this is said to constitute the richest manure. The best lands, however, bear annually three crops: two of rice and one of vegetable, and a very few, by dexterous management, even produce four, but all vegetables.

8. I do not think there is; the richest and most irrigated lands bear rice year after year and intermediate crops of vegetables; the hill sides are planted with buck wheat and sweet potatoes during the summer, and with wheat during the winter; whilst the former produce during the cold season a crop of mustard, the seed of which becomes ripe in April and May, and is extensively used for the sake of obtaining the oil.

9. The ashes of the common fuel, fir and dry grass, without any distinction, are put about the plants.

10. Not to my knowledge.

11. Extensively. Not so much on this island as on the opposite main, where they are carefully collected, ground, and applied for that purpose.

12. Not to my knowledge, for the Chinese eat every thing digestible.

13. They have no others but pigs and cows, and their manure they use like the human.

14. Not to my knowledge.

15. The former I believe are not manured, the latter as stated above.

16. Not to my knowledge.

17. They tie each of the branches tightly to prevent their growing, but the oak trees alluded to, are the dwarf oak, which if even allowed to grow spontaneously, never reaches a height above four feet.

18. Yes, constantly, without the cessation of a single year.

19. Human manure, ashes, ground, and oil cakes; the latter extensively in the barren sands of Fokien.

20. This is the fact, it would require very great research to find a weed. Almost exclusively.

21. The latter more commonly.

22. Yes.

23. Not to my knowledge, though grass is regularly burnt at certain seasons, to improve the growth of it in spring.

24. This is answered in the above.

The three requests could easily be fully and satisfactorily complied with.

The latter, if you wish to have it, Chinese, may very easily be obtained from a competent native.

[The Committee of Papers have much pleasure in directing the attention of Agriculturists, and other readers of the Journal, to the above interesting and

valuable replies from Correspondents in China, to the queries which were circulated in a former number of the Journal, and which are now reprinted for readier reference. They cannot allow the present favourable opportunity to pass, without again calling the attention of Members, in various parts of India, to the subject, and soliciting replies from them. None have hitherto been received, and yet a large amount of valuable information might easily be furnished without much trouble to those who are favourably situated, and must necessarily, from the nature of their pursuits, be acquainted with the peculiarities and composition of the manures used by native cultivators in their several districts. The Committee indulge the hope, that this second appeal will be successful, and that many will now be induced to follow the good example which has been set by observers in another and more distant quarter of Asia, in giving all the information in their power on a subject of so much interest and importance in Agricultural Chemistry.]

The Sugar Planter's Companion.

By L. Wray.

[Continued from page 128.]

The Irrigation of Cane Fields.

One of the most powerful causes of fertility consists in the irrigation of lands, whether the water used be derived from rivers, tanks, or wells.

As this subject is so very little understood generally, I would wish to investigate it briefly, in order to correct the misapprehension that exists, as to the influence it exercises. It is common to hear persons talk of irrigation, *merely* in relation to the grateful moisture, which it imparts to the parched and thirsty soil; evidently, without entertaining an idea of the various highly valuable constituents supplied thereby. We will therefore consider the subject under the several heads of river, pond, and well water.

In estimating the value of river water, I will call attention to the remarkable fertility caused by the annual inundation of the river Nile. An eminent author, writing on Egypt, after noticing the mountain sources of this river, thus con-

tinues: "The inundations of the Nile are caused by the periodical rains, which fall between the tropics. In June, it begins to rise, and continues to do so until the end of September, when it falls for about the same length of time. After the waters of the Nile have subsided, the ground is found covered with mud, which has been left there by the river. This mud, which is principally composed of argillaceous earth, and carbonate of lime, serves to fertilise the overflowed land to that degree, that though it has sometimes yielded two crops yearly, for upwards of 3,000 years past, yet does it still retain its ancient fertility, and requires no labour in tillage. This mud is also used as manure on lands not overflowed, with the best results, and it is sometimes made into bricks and various pottery, for domestic uses."

If we glance at the sources of this remarkable river, and the country through which it takes its course;—if we look back at it, as an impetuous torrent, rushing from the snow-capped mountain's height, disentangling, and in solution, carrying to the plains below those mineral particles which, together, form the very essence of fertility;—if we remember, that in its course, it flows through upwards of 2,000 miles of rich soil, and receives in that course, a vast number of tributary streams, each deeply impregnated with aluminous and other valuable earths, obtained from the various soils through which they pass; we cannot be in doubt as to the origin, or surprised at the extent, of the fertilising principle contained in these waters.

In India, we can allow the rivers to have the same effect in a great measure, although a vast difference does undoubtedly exist in the degree of fertility which they occasion, arising from the nature of the country and soil in which they take their rise, and through which they hold their course; as these more or less abound in rich mineral earths, so are the waters proportionately impregnated with these valuable constituents of fertility.

The sugar cane thrives luxuriantly, and delights in marshes, in argillaceous soils, in streamlets, and other places, where the change of water, constantly renews the supply of dissolved silica (Liebig).

The same writer, treating of irrigation, relates, " that in the vicinity of Leigen (a town of Nassau in Germany,) from three to five perfect crops of grass are obtained from one meadow, by irrigating it with river water, which is conducted over it in spring, by numerous small canals. This method is found to be of such benefit, that supposing a meadow not so treated, to produce 1,000 lbs. hay, then from one thus irrigated, from 4 to 5,000 lbs. are yielded."

In the family of the "*grasses,*" we find the " *Sugar cane,*" " *Rice,*" " *Indian corn,*" &c. &c. &c., included ; the same constituents of soil, therefore, required by one, would in a great degree be applicable to all, although it is evident that the sugar cane would make use of a larger proportion of such constituents, than would the more humble members of the same family.

Lands (according to the nature of the country) may be inundated at will, by means of sluices, or irrigated through the agency of " pumps," " water wheels," " hydraulic belts," " patent elevators," " Persian wheels," and a variety of other methods, now in use for raising water to the required height. Amongst the many, the natives still adhere to the old systems, transmitted them by their forefathers ; viz., the basket, and moat with a pair of bullocks. These being pretty generally known, do not require any further particularising here.

" Pond water" is generally very rich, and valuable for irrigation, in consequence of the quantity of vegetable matter which accumulates, and is constantly undergoing decomposition in it ; as also from the large supplies of rich earthy substances, which it receives at every shower, by the drainage of the surrounding lands.

Other advantages attend its use, amongst which, the small height, (in comparison to that of rivers and wells) which it has to be raised, is not the least.

"Well water" must of necessity be extremely variable in its qualities, and it is only by carefully analysing the water of each well, that we can arrive at any certain knowledge of its contents.* A much valued friend of mine, whilst residing in the Goruckpore district, made it a rule, in analysing the surface soils in his neighbourhood, to obtain bottles of water from the adjacent wells, by which means he was enabled to ascertain pretty accurately the value of any fields irrigated therefrom, in relation to the crop sown.

In analysing well water, Dr. Ure recommends that the sediment at the bottom of the well be subjected to due examination, to shew the nature of the precipitates contained. Water from wells is extensively used in irrigation by the natives of India, and in consequence, wells of all descriptions† are exceedingly numerous throughout the country, from the very ancient well of two feet in diameter to the more modern affair of grandeur and expence, with flights of steps leading to the bottom, and perchance a boat floating on its surface. Through motives of charity, thousands of wells are built, and rendered public by the richer portion of the natives, and although such benevolent acts are disparagingly spoken of, and usually designated "*nam ke wasté*," I cannot but think that commendation, instead of contempt, is due to those who take from their worldly substance large sums, for the purpose of conferring so signal a blessing on the poorer classes of their fellow-creatures. Whether we view this subject

* Native water is seldom, if ever, found perfectly pure. The waters that flow within or upon the surface of the earth, contain various earthy, saline, metallic, vegetable, or animal particles, according to the substances over or through which they pass. Rain and snow waters are much purer than these, although *they* also contain whatever floats in the air, or has been exhaled along with the watery vapours.—*Ure.*

† Not Artesian.

in relation to the relief and refreshment afforded to the "weary, way-worn traveller," who hungry and athirst, quenches that thirst, renovates his strength by means of a refreshing ablution, appeases his hunger with a humble meal of parched flour, moistened by the waters of the friendly well, and calls down, in sincerity of heart, a blessing on the (to him) unknown benefactor; or in reference to the poor ryots or cultivators of the soil in the neighbourhood, who besides the consideration of a pure and wholesome supply of water being provided for them, are thereby enabled, by irrigation, to save *many* a crop which would otherwise be lost, or so to increase the produce of their fields as to render them doubly valuable; whether we contemplate it in the one light or the other, we *must* acknowledge it to be an act which confers great and manifold benefits on mankind, and therefore one to be highly appreciated, extolled, and recommended as worthy of imitation.

Brief is the comment which I here venture to make on this most excellent and charitable practice, yet brief though it be, I cannot prevail on myself to neglect the opportunity, now afforded me, of expressing the esteem and respect which all such benevolent acts create in my breast, and distant, far distant I trust may be the time, when India shall have to bemoan the decay of such charitable feelings. According to the best authenticated accounts of the native cultivators, a good pucka well (such as would cost 100 rupees in the Goruckpore district,) is capable of supplying water for the irrigation of 30 pucka begahs (each two-thirds of an acre) of cane during the year, and the expense of raising and distributing the water, on the native system, may be stated as follows :—

		Teeka work.		
2 pair of Bullocks to each moat, at 2 ans. =		0	4	0
4 Men, ... ditto ditto, at 1 an. =		0	4	0
	Total Annas, ...	0	8	0

One pair of bullocks, work from day-light to ½ past 11 *o'clock* A. M., *and the other pair* from ½ past 1 P. M. to 5 o'clock in the evening, during which time they irrigate one-third of a pucka begah ; that is, two-thirds of an English acre in three days, which *would therefore cost one rupee and* eight annas. Of the four men above-mentioned, one attends to the discharging of the moat, one drives the bullocks, one makes little channels to conduct the water over the field, and occasionally assists the other man in scattering the water wherever it is required. For this latter purpose, small light wooden shovels are used, in the handling of which many of the native labourers, from long habit, display great dexterity and powers of endurance.

According to the size of the well, and the quantity of water it is capable of supplying, so are the number of moats to be placed in each.

I have seen as many as eight at work in one well, although three or six are more common. With the latter number, two pucka begahs can be irrigated per diem at a cost of three rupees. I do not however intend it to be understood, that a well of this size can be constructed for 100 rupees, as that sum would suffice for the building of one, capable of working only three moats at once, and irrigating one begah a day.

At *this* rate, a planter having a concentrated cultivation, or even so far concentrated, as to have it in patches of thirty begahs together, would only require 20 wells = 2,000 rupees, for a cultivation of 600 pucka begahs (200 acres.) It will be perceived by this shewing, that as each well can only supply water for *one* begah per day, it would take thirty days to get through its allotted portion of land, and consequently each begah could only receive *one* irrigation every month. In peculiarly hot or dry seasons, however, lands of a thirsty nature will demand a more frequent supply of water ; it would be advisable therefore in such situations, to allow a well to each twenty begahs ; the extra expence

attendant on such increased liberality, being sure of its reward in the return produce.

We cannot view this subject to better advantage than by having before us, a correct estimate of the various items of expence, entailed by the construction of wells, and irrigating therefrom. *On an estate of 600 pucka begahs, these would appear to consist of*

		Rupees	Ans.	P.
30 pucka wells, each 100 Rupees,... ...		3,000	0	0
600 begahs cane planted in February, March, and April, *id est*, 200 in February demanding four irrigations @ $\frac{1}{8}$ per begah = 1,200 Rupees, ...	1,200			
200 in March, with three irrigations @ $\frac{1}{8}$ = 900 Rupees, ...	900			
and 200 in April, with two do. @ $\frac{1}{8}$ =	600	2,700	0	0
Total Rupees, ...		5,700	0	0

This then, appears to be the total outlay under this head, for the first year, on an estate, situated in a dry part of the country, and where neither river, nor pond water could be made available for the purpose. In extraordinary cases (as before mentioned) this amount would be exceeded in the number of irrigations required, but it must be borne in mind, that these pucka wells, *once* constructed, would last for a number years; the expence of irrigation the second and succeeding years being merely for labour.

In calculating on the above premises, however, it must be very clear to every one, that I am taking an estate, placed under the most unfavourable circumstances, and situated in a locality, such, as no judicious person would be inclined to fix on. On reference to page 43, it will be seen, that in the settlement of an estate, (especially in this country,) a very important point to be secured is—" *water;* for irrigation and water carriage." The banks of some river, (if not sub-

ject to inundations,) with a few large ponds, &c. are advantages which it will behove the planter to look to, in choosing a site for a sugar estate. This great object secured, the whole sum above shewn for the construction of wells would be saved, except for one or two, perhaps, about the "*works,*" for the supply of drinking water, and other necessary purposes.

Besides this, it must be remembered, that the lift from the generality of rivers and ponds, is by no means so great as that of wells—whilst the supply of water is more certain, abundant, and fertilising.

The methods of raising water are so numerous and so different from each other in their mode of action, that a person need study long and closely, to be able to make a proper choice. Each method has its own particular admirers and advocates, whose various statements, counter-statements, contradictory accounts, and incessant wrangling for precedence, serve in no slight degree to perplex and confuse.

Those which have obtained patronage in this country appear to be, " the Common pump," " Persian wheel," " Chinese chain pump," and " Walker's patent elevator;" but in the application of power to each and several of them, what surprises me much, is, the entire neglect of " *wind,*" as a propelling power. It would be very difficult to point out another country in which the winds are so peculiarly favourable for this purpose. In a great many parts, the east and west winds blow with great force and steadiness, alternately, from the month of March until June, which are the very driest months in the year, and the time when irrigation of lands is most required. At this period of the year, I myself have known the west wind to blow *incessantly* for the space of a month, and that too so strongly, as to have been extremely suitable for-mill work. In Jamaica, great numbers of wind-mills, both large and small, are to be seen constantly at work, either in grinding canes, drawing water, or some

such employment. Why, may I ask, are they *not* used in India? Is wood, labour, and every single article required in the erection of a wind-mill, not plentiful and cheap? Can any thing, indeed, be conceived more cheap, than would be, the construction of a few *small* wind-mills, suitable for this purpose? I think not, and as the plea of uncertainty in their work cannot be entertained, I know not what can be urged against their general adoption. On the banks of rivers, in ponds or wells, they are alike applicable, as they also are, to every known method of raising water.

So impressed am I with the belief, that wind-mills are *peculiarly* adapted to this country, for the purposes of irrigation, that I will venture to recommend them most strongly to the attention of my brother planters.

The native modes of irrigation, such as that already detailed, and others, are decidedly very simple and cheap; but it is to be believed, that by the aid of machinery and European skill, the work would be more effectively performed; and at a cheaper rate even. Let us look at the late celebrated invention of Walker, generally known as "*Walker's patent universal water elevator*," and note the astonishing performances that are attributed to this "wonder-working machine." So many accounts have been before the public, that I shall here only mention the fact of one having recently arrived in this country for the purpose of raising water for irrigation. It requires a *two-horse power*, and is to deliver 600 gallons per minute, twenty-five to thirty feet high; equal to about 61.716 cubic feet, or 2,110 tons per diem. Now at this rate, suppose we allow each square yard to receive 3 gallons of water, and make a large allowance for wastage, &c., yet these will be sufficient for the irrigation of 25 acres of land!! Should this really prove on trial to be correct, it may with the greatest propriety and truth be denominated, "*a wonder-working machine;*" but by all the usual modes of calculation, based on certain known laws,

we cannot produce any such *extraordinary result; so far* from it, indeed, that we are greatly inclined to pronounce it *utterly impossible!*

"The hydraulic belt" was also pledged to perform great things for us, yet we can scarcely take up a single work on these subjects, but we find it ridiculed and condemned; however, putting aside this evidence, I will just mention the idea I obtained of its merits, from the critical remarks of a very celebrated English engineer, who accompanied me to the Polytechnic Institution in London. It would appear that the extraordinary velocity at which the hydraulic belt must be worked, requires such an amount of power, as would be more than sufficient to work a pump capable of throwing far more water; that the web used as a band, would entail a constant expence from its liability to rot, and wear out; that in its every part the friction, and consequent wear and tear, caused by such great velocity, would speedily bring it to the workshop for repairs; and in short, that the common pump was far preferable in point of "*certainty*," "efficiency," and "economy."

Its chief recommendation in *India* is its extreme simplicity, and the very cheap rate at which the natives can supply the "*web*" or band. I will even go so far as to express my belief, that *were* a few slight alterations made in it, planters and others might find it in some degree worthy of attention.

These alterations appear to consist in a number of small shallow pockets or catches to be placed on the outer surfaces of the band, *so open* or *extended*, as to *ensure* a discharge of their contents at the top of the upper wheel, otherwise the centrifugal force would carry the water round and round, *without* allowing of a discharge; the quantity of water taken up by each of these pockets, would be very small, but their great number, and the velocity at which the band travels, would cause a very considerable delivery. But in case the increased weight of water, consequent on the adoption of

this plan, should be found too great for the friction of the revolving wheels, I propose to have the upper wheel grooved longitudinally, so that by having cross pieces of leather, &c. &c. on the *inner* surface of the band, (which would work in the grooves,) the resistance might be overcome, and the band carried round.

"The Persian wheel" is very much used up-the-country by indigo planters, and is said to deliver a very large quantity of water. It is principally worked during the manufacturing season, in filling cisterns, vats, and reservoirs. It does not consist with my knowledge, that it is ever used for the purposes of irrigation in India. Although we are aware that on the Nile, Euphrates, and many other rivers, it is extremely common, and has been so for ages and ages past.

"The Chinese pump," as it is termed, is also very common in some parts of lower Bengal, and is much esteemed. Through the politeness of the proprietor of "Bowsing" Factory, (Burdwan District,) I had the satisfaction of seeing one in full work. The water was delivered in a continuous stream of very respectable magnitude, and I was altogether much pleased at its performance, although I observed that the application of its moving power admitted of improvement.

The subject of irrigation should engage the earnest attention of every East Indian sugar planter, inasmuch as cane cultivation in the greater part of India, can by no possible means be carried on, successfully, without its aid. In so vast a country as India, a most extensive field is open to the planter for choice of cane land, and it surely will be his interest to fix on those localities, which afford him the greatest number of advantages. But in so choosing, I would advise him to use great discrimination. He may find land requiring *no* irrigation, which would be far from any navigable river, thereby entailing ruinous expence in the article of inland carriage, or he may secure *this* point, and neglect

others. In forming his judgment, I therefore would, in conclusion, wish to impress two facts on his mind; viz. the actual *cost of irrigation throughout the country, (averaging two rupees the pucka begah);* and the great fertility it occasions, *independent* of the refreshing and invigorating tendency of the moisture imparted.

Some time since I was visiting a friend, who pointed out to me some fields which, he said, had been cropped from time immemorial; they require no manure, yet yield most abundantly every year; the only thing they demand, is plenty of water; "but," he observed, "*that's* nothing, for there are wells close at hand." This he said in a triumphant manner, which led me to propose a walk to the spot. I examined the soil as I walked on, but found it by no means possessing what I should consider an over fertile appearance, I therefore requested to be shewn the wells.

"Oh!" said my friend, "you can see nothing there, the water is very bad, the natives won't drink it." This made me the more anxious, and I speedily had a *lota* full raised for my inspection. I found the water slightly brackish, with a disagreeable putrescent smell, nearly akin to that of sulphurated hydrogen. I saw at once the cause of fertility in these fields, and in my turn, had a laugh at my astonished friend. I have since regretted, that the nature of my business made me neglect to take a bottle of this water for a chemical examination.

(*To be continued.*)

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. VII.—1843.—Vol. II.

The Sugar Planter's Companion.

By L. Wray.

[Continued from page 160.]

CHAPTER II.

The works necessary in the Manufacture of Sugar, comprising an account of the Mill, Boiling, Curing, and Distil Houses.

The Mill-House.

After the sugar cane is cut, it is brought by carts and deposited in the mill-yard, close to the mill-house door or archway, so as to be at hand for the cane-carriers, who supply the feeding board.

The power used in propelling a sugar-mill, is either "wind," "water," "cattle," or "steam," each of which, with their peculiarities, I will now proceed to discuss.

A wind-mill is extremely useful in many parts of the West Indies, where a good breeze may for the most part be calculated on; but the great expence of construction, together with the tiresome uncertainty of its performance, have of late years, thrown them in the shade. The cost of erection in Jamaica is quite enormous, and no small capitalist has much fancy for them, especially as they often are entirely useless, at the very time, when their services are most required.

I once resided on an estate that had a wind-mill of extraordinary power and efficiency, yet was very uncertain in its work; for two or three weeks, perhaps, it would be every day at work, then for lack of wind, it would be idle during the space of a week or ten days, so that had we not other means at hand to grind off our canes, the crop would be entirely ruined. It is an invariable practice, however, in Jamaica, to have a cattle-mill on every estate that has a wind-mill, using the former, when the latter stops for want of wind. It may be interesting to my readers to be informed of the manner in which we were obliged to proceed on an estate, having a wind and cattle-mill. The accompanying rough sketch, shews the probable position of the three houses; viz. the wind-mill, cattle mill, and boiling houses. The two former occupying a higher situation than the latter, as affording that inclined plane for the gutters, which will allow of the liquor flowing at once into the cold receivers, clarifiers, &c. (in the boiling house,) and from thence being drawn down through cocks into the grand copper or first evaporater, as will be more particularly shewn hereafter.

In carting home canes, so many carts deposit their loads at the wind-mill, to be ready in case of a breeze springing up; and the remainder supply the cattle-mill. Thus the cattle-mill continues working until the "*boatswain*" of the wind-mill finds he can work his mill, when he at once leaves

any "*odd job*" he may be on, and taking his two feeders *(men)* with him, proceeds at once to the manager. "Plenty of wind massa for wind-mill work, shall I put him in a wind, massa?" "Oh, certainly," says the manager, "stop the cattle-mill, take all hands up with you, and be quick in putting her in the wind; be smart my lad, and lose no time now."

In a moment the cattle or mules (as the case may be) are dropped, and all hands betake themselves to the wind-mill. The six mill boys join the four cane carriers in supplying the feeding board; the two cattle feeders *(women)* join the "green trash carriers;" two strapping fellows with might and main are feeding up the mill, aided and assisted occasionally by the energetic example of *the* "*boatswain*" himself; the *other boatswain* (of the cattle-mill) is outside encouraging on *his* gang, and calling out lustily for a song; men, women and boys respond heartily to the call. "Mr. Barratt come dance for de nyoung galls, monkey loss him tail, hold him," or some such elegant ditty is immediately put in requisition; no coughs or colds, or maiden bashfulness can deter old or young from performing their part in the vocal concert. The whirring of the wind-mill seems to exercise a magic influence over all. Even the manager is affected, and walks about as pleased as a tickled fish, whilst he drinks in the melodious strains of his band of choristers. The rattling of carts, cracking of whips, groaning of the mill, and the merry song together form, to him, one harmonious whole, which while it pleases the ear, tells of work performing, crop progressing, and good-will reigning amongst his people.

If the wind was found to be dying away, the mill-boys were despatched to the cattle pen for the mill-cattle, and when they had made all ready, the wind-mill was put out of the wind, the *boatswain* of the cattle mill drew off all his hands to the other mill, leaving his brother *boatswain* and men to wash down his mill, and have it white-washed. That necessary precaution being taken, they also returned to their

"*odd jobs,*" somewhere near the works. *Such* was wind-mill work in days gone bye. It was as rapid, as it was powerful and efficient in its performance of work; it spelled the cattle and mules on the estate, thereby saving them from a vast deal of hard and harassing work, whilst it gave rise to scenes of good-humoured mirth, and exhibited its exhilarating influence in the number of jocund songs which rent the air.

This is a faithful summary of its advantages; but whether it would be applicable to India in sugar operations, or not, can only be decided by considering the average state of the wind during the manufacturing months.

As to the *cost* of erection, the following will perhaps serve to convey some idea.

Rough estimate of cost in constructing a wind-mill, for sugar cane crushing, in the district of Goruckpore :—

	Rs.	As.	P.
Bricks, (hard burnt,) one Lac, ...	150	0	0
Lime, ...	120	0	0
Goor, ...	25	0	0
Soorkee, ...	50	0	0
Wood, ...	100	0	0
Iron and Brass, ...	135	0	0
10 Masons, 45 days @ 6 per month, and Mistree @ 10, ...	105	0	0
12 Carpenters, two months, ...	150	0	0
Blacksmiths, ...	40	0	0
Coolies, Men, Women and Children, ...	80	0	0
Total Rs.	955	0	0
Say incidental,	45	0	0
Grand Total Rs.	1000	0	0

Here we have 1000 rupees in the Goruckpore district, to which must be added say 3000 more, for a good iron crush-

ing-mill of English manufacture, to be worked by it, making altogether some 4000 rupees. This estimate would not apply, in parts where bricks, mortar, wood, labour, and other necessaries are expensive; but in such places, up country, where these articles are cheap, and the wind pretty steady.

A water-mill is, in my estimation, the best of all mills, where water can be obtained in sufficient abundance. There are three varieties; viz. "the overshot," "the breast," and "the undershot" wheels, each being more applicable than the other, as the situation and supply of water may differ. The former is, however, by far the most powerful and desirable, but requires greater advantages of situation to secure a good fall. The Deyrah Dhoon, and many other parts of India, I doubt not, afford such advantages, and where they do occur, those sites should be specially marked. Only look at the Americans, how keen they are in buying up spots which can boast of "water privileges," and how quick in availing themselves of the advantages connected therewith. Saw-mills, rice-mills, flour-mills, sugar-mills, &c. &c. without number suddenly spring up, as if by magic. We have accounts of the Otaheite and other descriptions of cane thriving most admirably in the Dhoon; it is therefore for the Planters in those parts to look around for such desirable and powerful aid.

I was once residing on an estate in the parish of St. David's, Jamaica, possessing an overshot water-mill, which frequently supplied us with juice for 32 tons of sugar per week, and I am persuaded could have performed a much larger proportion of work, had the boiling house been capable of keeping pace with it.

The breast wheel is not near so powerful as the foregoing; but is more easily provided with a locality, as it only requires a fall of half its diameter. In every other particular, it is similar to the overshot.

The under-shot wheel is the most ancient and best understood of all mills. It is capable of being worked in places where a body of water flows with much force, either as a river or large stream.

For the purposes of cane grinding, it was some years since much used in Demerara; but latterly they have been very generally superceded by steam engines. In Demerara they are denominated "tide-mills," and are worked by the force of the flood and ebb tides. They are, however, almost universally pronounced to be inconvenient, uncertain, and even dangerous; especially when situated on rivers, subject to a sudden rise, not unfrequently being washed away there by, bank and all.

These circumstances, combined with the intimate knowledge generally possessed of the peculiarities of this kind of wheel, induces me to forego any further notice of it.

A cattle-mill is like a good old servant, who will never forsake us. Wind, water, and steam cannot always be made available; but cattle are generally abounding. By their aid our mills can be kept going at a jog-trot; a slow but *sure* pace, which will, without fail, bring us to the end of our crop. To counter-balance this, we must take into consideration the number of stock which must be kept on every large estate, having no other propelling power, and the tedious length of time they generally occupy in taking off a crop. A good cattle-mill worked by ten strong bullocks would, in Jamaica, yield about 400 gallons of juice an hour, at which rate, (if at work eighteen hours out of the twenty-four,) it would average eighteen skips of sugar, equal to three tons per diem, and would require six spell of cattle, or sixty head, divided again into two grand spells; viz. the A. M. and the P. M. of thirty each.

The morning spell grinds 3,600 gallons, and the afternoon spell the same, changing the cattle every hour of 400 gallons, which gives them three periods of labour each, and does not

distress them so much as otherwise. This is a good plan, for by thus working *one* hour and resting two, their work comes comparatively light on them, and they maintain their courage unbroken.

To work the same mill in India, I should say, it would require 16 cattle of good strength for the like work; therefore, six spells would amount to ninety head, and allowing two to each spell as relief stock, the total of mill-cattle required, would be 108. As to the amount of produce which would result from this duration of labour *here*, I cannot properly estimate it, except by the actual trial of various descriptions of cane. I will, however, venture to express it as my opinion, that *two* such mills as above premised, with 220 good strong cattle, would be sufficient (under proper management) to work off a crop of 15,000 maunds of sugar in the space of 150 days, which includes 25 days' allowance for stoppages, &c. These 220 bullocks, together with about 200 more for ploughing, carting, &c. will be the whole necessary on an estate of that capability, and would cost about 6,000 rupees, independent of the food they would require, out of crop, or during seven months of the year. Apart from the value of their work on an estate, must be reckoned the very large quantity of manure which such a number of cattle would realise, by the methods advised at page 118, and their great utility for the purposes of "*fly-penning*," as treated of at page 126.

Taking everything into consideration, I am therefore very much inclined to doubt, whether keeping up a large amount of horned stock on an estate in this country increases the expence. If 420 bullocks cost 6,000 rupees, it must be remembered, the *work* they will, with *good treatment*, perform during a period of five years on an average, and the quantity of manure they will furnish annually.

This, I think, with the aids before mentioned, will be sufficient for the produce of 500 tons of sugar per annum, a return which will be found abundantly remunerative.

But there is another class of cattle mills, which may perhaps be treated with sovereign contempt, although most simple, cheap, and efficient. These are small wooden-mills, made in the same manner as the common vertical mill, that is, with three rollers, dumb turner, &c. &c., only much smaller and with only two arms or levers, so as to be drawn by one bullock at each arm, with an allowance of four for the twelve hours, two on, and two resting or feeding, &c.

Each mill would therefore require four bullocks; two boys as drivers, one carrying cane, one feeding and turning trash, and one carrying away the trash.

Making a total of	2 Men, at $1\frac{1}{2}$ anna each, ...	3	Annas
	3 Boys, at 4 pice each, ...	3	,,
	4 Bullocks, at 1 anna each, ...	4	,,
	Per day,	10	Annas.

Ten annas a day, during which they would grind about 400 gallons of juice, or something more than 33 gallons per hour. This quantum of work could be easily performed by one of them, if the canes are soft and juicy like the Otaheite, Bombay, and other generous varieties. Twenty of these mills would at this rate grind 8,000 gallons of juice a day, equal to rather less than 4 tons of sugar.

Each of these simple machines can be constructed of fine, tough, well-seasoned wood, at a cost of not more than 50 rupees; and if out of order any time, a common village mistree can readily repair it.

As I know that ocular demonstration is the most certain mode of convincing people, I am about having one made of the full size required, which, when finished, I shall be most happy to shew any one who may wish to see it, or even to appoint a day whereon to put its capabilities to the proof.

Such mills are well adapted to the nature of the country, and to the prejudices of the natives; they would be quite at

home with them, and would be almost led to fancy, that they had their own dearly cherished old affair at work. In short, they demand our every attention by reason of their extreme simplicity, efficiency, and cheapness, (20 not costing more than one thousand rupees.)

Amongst the stock used in cattle-mills in this country, I am much surprised to find, that mules are quite overlooked, —the most hardy and excellent animal we can have for work. They are exceedingly cheap about Allahabad, and further up the country, their price ranging from 7 rupees to 50 rupees each; numbers of them might be procured at a very trifling expence. I once saw some at work, and was led to enquire their cost; the owners told me, "Sahib, we bought these mules for about 10 rupees each; but we cannot sell them, as we are engaged in transporting bricks from place to place on their backs, and would therefore lose our living; but if the Sahib will send peons a couple of days' journey off, they can bring as many as you may require, some 7, some 8, 10, 20 to 50 rupees the very best; those for 10 or 20 rupees very good and strong, will make plenty of work, and never die."

This graphic account I afterwards found tolerably correct, save and except as to their immortality. Fine mules are to be procured within a short distance of Allahabad, excellently suited to mill work, that will only cost from 15 to 20 rupees each. With kind and attentive treatment, they will continue working 25 years. I have even known mules in Jamaica upwards of 45 years old, working as regularly and as effectively as the young animals. I have seen a mule, 20 years old, sell for 50*l.* to a man who well knew her for 12 years, and therefore was not taken in as to age; for she had a good 20 years more work in her at the time, and it was even a matter of favour that she was sold to him for that sum. Mules are very strong, hardy, long-lived and valuable animals, suitable either for burthens, carts, mills, or other work, and as such, I strenuously recommend them to the East India sugar planter.

The construction of a cattle-mill is so generally known, that it needs no description here, I will therefore pass on to the "STEAM ENGINE," which is the most powerful moving power that we can call to our assistance.

For the purpose of propelling a sugar-mill, it has long been used with the most eminent success. In many parts of India, as Tirhoot, &c. &c., they are even now employed to some extent in grinding canes. In a distant country like this, one great objection arises; viz. the distance to which an order must be sent for one, the length of time it takes to reach this, and the risk the planter runs of having an inefficient and worthless engine palmed on him; some parties being often so reckless of permanent advantage, based on integrity of character, as to prefer present gain and fraudulent profits to honorable dealing and fair emolument.

This is a serious consideration, and I know no better method of preventing such untoward occurrences, than by mentioning the name of Mr. J. T. Beale, of East Greenwich, near London, than whom, a more clever engineer and honorable man does not exist. Any order sent to him, I have no hesitation in vouching, would be honestly and satisfactorily executed.

His engines are of the most simple construction, and on a greatly improved principle; so simple indeed, that no man of common intelligence could fail to understand at once the necessary mode of management.

I have been thus particular in mentioning Mr. Beale, being well convinced of his great skill and integrity. Porter, writing on the choice of mills, is very urgent with the planters on this point, and remarks:—

"As the whole success of the crop is endangered by any accident happening to the mill, it is of the first importance to have this faithfully and strongly constructed and put together; nor will it be found prudent to look too closely to the cost of a machine, the maker of which can find many

ways of securing his usual rate of profit, even when the price has been fixed at an apparently moderate rate. Where so much *real* difference exists in the intrinsic value of the material used, as well as in the quality of the work supplied, it must surely be the truest economy to pay a fair price to some tradesman having a reputation to sustain, rather than to seek after a low priced commodity, which may shew its deficiencies at a moment, when the consequences would prove truly disastrous.

"Where steam engines are employed in the colonies, we believe they are always on the low pressure or condensing principle, which is, perhaps, one reason why their use has not been more extended. Reducing as steam power does, every operation to a certainty, it must be advantageous to call in its aid whenever it is practicable; but engines of this construction, besides being expensive in fuel, require a very abundant supply of water for condensation, and this is not always in the command of every plantation. In the newly settled colonies of Guiana, where water is in great abundance, steam engines are almost universal, even when resort can be had to the much cheaper agency of tide-mills, since these latter are of course intermitting in point of time, and are found to be less regular in their performance. High pressure engines, which are the simplest of all steam engines, and the least expensive in their construction, can be worked with one-seventh part of the water required for condensing engines. If properly made and rightly proportioned, they are less wasteful of fuel, they are of less weight, and occupy less space; while from their greater simplicity, they are more easily kept in repair.

"An opinion unfavourable to the use of high pressure steam undoubtedly exists through apprehension of danger, and it is certain, that this apprehension was formerly well-founded; this, however, is no longer the case, and we believe that it will be found, on enquiry, that the proportion of accidents oc-

casioned by the bursting of boilers, is *greater with condensing, than with high pressure engines.*"

I entirely coincide with Mr. Porter, as to the superiority of the high pressure engine for a sugar-mill, and its present acknowledged safety.

It is some years since Mr. P. wrote the above, and great changes have taken place in regard to the steam engine. The prejudices and fears which were then entertained with respect to its adoption, have long been cast aside as groundless, and we now see them in active service in all parts of the known world; each succeeding year has witnessed their more general use and increased safety, and numbers are now hastening to avail themselves of their powerful services, without entertaining the least alarm.

A planter being once in possession of a steam engine of good construction and honest workmanship, need be under no apprehension as to the efficient performance of its work. If kept properly cleaned and oiled, it may be put to constant work for many years; give it but fair play and a moderate degree of care, and it is my opinion that an engine of *ten-horse power* will take off a crop of 500 tons of sugar for ten years in succession, without suffering any material injury, or requiring any thing more than some trifling repairs.

Allowing that at the expiration of that period, a new boiler was required for the engine, yet that expence would be but comparatively small, as the engine itself would continue in good serviceable condition for at least ten years longer; supposing, of course, that it was not ill used and neglected.

A steam engine may be worked by night or by day, without respect to time or seasons, and is a servant that wearies not, nor falters in its task.

Its chief disadvantages on a sugar estate in India may be reduced to three; viz. the expence of fuel, the lack of competent engineers and attendants, and the difficulty of repairing

any damages which may in the course of events occur, through mismanagement or accident.

The fuel required is either wood or coal; the former generally consists of moderate-sized logs, calculated to give forth a degree of heat sufficient to keep up the steam, without that inequality caused by small wood, blazing up at one moment and dying away the next. The fire requires to be kept as near as possible at an equal degree of heat, (after the steam is once up,) and for this, small hard wood logs furnish the best fuel, which perhaps the planter can command. Dry cane trash alone is used for the boiling house pans, therefore only the distil house and engine boiler will require wood, and if these can be readily supplied at a cheap rate, this point will be disposed of at once; but it often happens in an open and cultivated country, that wood is not to be obtained, except at enormous rates; in such case, the planter must procure *coal*, which, in the present state of India, is very expensive and difficult to be procured in many parts of the interior. The time will, I do not doubt, soon arrive, when coals will be sold far cheaper than at present, whilst the modes of transit will be more numerous and less expensive.

The next regards the engineers and necessary assistants: one competent *engineer*, and two clever Bengallee assistants, would be the very least that would suffice on an estate of 500 tons; and their cost to the estate would be about 300 rupees per mensem to the former, and 30 rupees to each of the latter, which with horse and houses, would bring the expence to about 5,000 rupees per annum. This is a very moderate calculation, to which we must again add stocker men and other inferior attendants.

In case of an accidental breakage, it would be the duty of this engineer to procure two or three good native blacksmiths, and with their assistance endeavour to repair it; if past his ability to manage, down it must be sent to Calcutta, from whence it would find its way back, perhaps, in one, two, or

three months, with a *small* bill for damages repaired, accompanying it. In Jamaica the way this is arranged is as follows: Every estate with a steam engine has *one careful* negro, (if performing night work then *two,*) constantly to attend it; he oils and keeps every thing clean about it, and suffers no unauthorised persons even to enter the room in which it is. Twice or thrice a day the manager looks in to see that he performs his duty in a proper manner, and once or twice a week the engineer visits his charge, and narrowly inspects every part, and receives the report of the negro attendant.

This engineer is usually an European who resides in the neighbourhood, and has a fixed salary of about £30 sterling per annum from each of the surrounding estates, for attending to their engines. Should any part chance to break, he is at once summoned, and if the fracture be but slight, he with the aid of the estates' blacksmiths, quickly repairs it. But should the injury sustained surpass their capability, it is sent off with all despatch to the nearest *working* engineer.

In India, the want of such a system as this will continue to be much felt, until steam power becomes more generally adopted throughout the country, when engineers will most probably find it to their interest to settle down as in Jamaica.

The following are the hands required in a mill-house, worked by cattle or steam :—

Cattle, Mill, People.	*Steam Mill.*
1 Boatswain or Headman,	1 Boatswain or Headman,
3 Cane Carriers,	2 Feeders,
2 Feeders,	6 Cane Carriers,
1 Trash Turner,	1 Trash Turner,
1 Mill-bed Cleaner,	1 Mill-bed Cleaner,
3 Green Trash Carriers,	6 Green Trash Carriers,
5 Cattle Boys,	1 Call Boy.
—	—
16 Total, one spell 10 hours.	18 Total, one spell 10 hours.

If working *double* spells, (as a planter must do, who to take off his crop quickly, he keeps the mill about for 20 hours out of the 24,) then he will have two spells, each working ten hours.

A good water or wind-mill will take much the same number of hands as the steam engine.

The Boiling-House.

The boiling-house most justly demands the very greatest care in its *construction,* as well as management. We may plant our canes, and even have them expressed properly, but if the boiling-house be not constructed on just and true principles, we cannot manufacture the juice into sugar, so as to make a profitable return on our exertions, and the outlay of our capital.

Our utmost attention should therefore be directed to this important subject, that we may obtain the highest degree of success, both in the quantity and the quality of our sugar.

The "cold receivers" in the boiling-house are foremost in their reception of the expressed juice, next are the "cyphons" or "clarifiers;" "the boilers;" and lastly, the "coolers" receive it in a concentrated form.

These cold receivers are to be made of good seasoned wood, and lined with sheet lead, zinc, or copper; otherwise the wood becoming tainted with acid, would entirely spoil all the juice, which day by day passes into, and through them, from the mill to the clarifiers.

They are usually two in number to each set of boilers, and contain a quantity equal to that of the clarifier.

Their utility is very great; in the first place a great quantity of extraneous matter rises to the surface, and admits of the juice being drawn through a cock into the clarifiers, in a more pure state than would otherwise be the case; secondly, as very

frequently happens, the boiling-house, not being able to keep pace with the mill-house, becomes full of juice, which obliges the mill to be stopped, and proves a serious inconvenience should the mill be propelled by steam. Now by being provided with these cold receivers, this is in a great measure obviated. Let us instance a boiling-house with a double set of pans, four clarifiers, and two receivers, which when all full, stops the mill until room can be made for more juice, and at *least* two hours will elapse before it can prudently be put to work again, during which time the mill-gang can be usefully employed in some light work about the yard, instead of losing their time. It is indeed a common thing in Jamaica to have even a greater number of these receivers than above-mentioned, so that the mill-gang strive to have all full by six or seven o'clock in the evening, then stop the mill until next morning, as the juice would be sufficient in quantity to keep the boiling-house at work until near midnight, and even leave some in the boilers to commence work on in the morning, say at 4, 5, or 6 o'clock, as may be ordered.

The cyphons or clarifiers are copper or sheet iron pans, of about sixteen inches in depth, and the circumference corresponding with the quantity contained, which is equal to that of the grand copper, or first evaporating, boiling pan.

The bottom of the clarifiers should be of a concave form on the outer surface, which renders them less liable to warp than when flat bottomed, whilst it does not take so much fuel in heating. Each cyphon should be hung over a separate fire, and have a cock at the bottom nearest to the grand copper, through which the liquor when clarified, can with facility be drawn down.

To attend on these cyphons, a very careful and intelligent man is always appointed, (with his mate,) whose office it is to keep them in the *highest state* of cleanliness, and perform those other duties attendant, which will be hereinafter mentioned.

The boilers or coppers receive the clarified cane liquor from the cyphons, and perform on it those changes, arising from evaporation and concentration, as it passes from one boiler to the other, and is exposed to an increased degree of heat. Boilers may be of wrought iron, cast iron, sheet iron, or copper, and vary in size, form, and number, as the planter may deem desirable.

Iron boilers were almost universally used in the West India Islands some years ago; but in Jamaica the change has been so entire, that during a residence of ten years, I never once saw an iron set, copper pans having completely superseded them throughout the island. In the small islands, as Grenada and others, also in the French possessions, they are however still in use to this day. The chief recommendation, (perhaps the only one) in favour of cast-iron boilers, is their very great cheapness in comparison to those of wrought iron and copper; whilst their liability to crack, and thereby become entirely irreparable and useless, would seem to lessen very much, even *this* recommendation. Good casting, and afterwards careful cleaning, when working, will often insure a long period of service to the planter, which the testimony of an old Grenada planter fully proves. This gentleman assures me, that he had a set of cast iron boilers, with which he took off the estate's crop for *fifteen* years in succession, without the slightest injury being sustained by them; in fact, he says, they were as good at the end of that time, as on the first day they were used.

Wrought iron boilers are much more expensive than the foregoing; but I much doubt if any could be found capable of being worked for so long a time as 15, or even 5 years, for though they do not crack, yet the nature of their work causes them to wear out quickly, by the constant shelling or scaling off, of the iron. I have seen but two sets of wrought iron boilers at work, and for a very short time, yet I observed that the cane liquor boiled well and quickly, taking an hour

and half to the *first* skip, which would be equal to a skip an hour; this rate of boiling being considered in Jamaica *good work.* Copper boilers, without doubt are the best of all, but as they are very expensive, many small capitalists would wish to run their chance with the others, rather than incur so great an expenditure in this particular department. To take an economical, yet safe method is therefore advisable, and these two objects may be combined by having the *concentrating* tache (to each set) of copper, and the others of cast iron.

To the size of the boilers I would attach little importance; seldom two sets on different estates agree in this respect: the following is however a very good arrangement of quantity; viz. grand boiler* 400 gallons; 2d ditto 320 gallons; 2d tache 200 gallons; and tache 90 gallons.

The *form* of the boilers is a very material consideration: they are generally made elliptical, semi-circular, and *sometimes* only *slightly convex*. This latter is decidedly the most advantageous form, not only in regard to enonomy of fuel, but also greater expedition in boiling, and far, far less liability to burn at the upper sides of the boiler.

The number of boilers used, also differs much, and various are the opinions entertained as to the number which will produce the best results, such as combine *expeditious concentration* with *economy* of *fuel*, and furnish a *large return* of a *superior quality*. For my own part, I always found two clarifiers, three evaporators, and one concentrator answer the purpose very well.† Some persons, however, prefer four or five evaporators and two concentrators to each set, whilst others again have a number of different plans. In India I believe the planter will find the arrangement shewn in the ground

* These are also termed, 1st evaporator, 2nd ditto, 3rd ditto, and concentrator.

† Shewn in ground plan of sketch, a boiling-house with two sets of boilers, altogether equal to 500 tons of sugar per annum.

plan sketch sufficiently simple, compact, and efficient to suit all his wants.

A boiling-house, &c. constructed on this plan, entails very small expence or trouble in working it. The cane juice liquor flows by a gutter from the mill-house into the cold receiver, from whence, by turning the cock, it runs into the clarifiers, and when clarified is drawn down at once into the grand evaporator. The scummings of the boilers are conducted by a gutter direct to the scumming's receivers in the still-house; thus the only carrying that is necessary is when *potting* sugar, *id est*, removing it from the coolers to the curing boxes in the curing-house, which being immediately above, the molasses, as it drains, runs down into the molasses receiver in the still-house without the least trouble. No pumping, no carrying on people's heads, or other harassing and expensive work; all is compact, convenient, and well arranged, and serves to ensure cleanliness, save labour, and expedite business.

The coolers are shallow wooden receivers, which receive the concentrated syrup from the tache until it granulates, and becomes sufficiently cool for potting.

On this account they are not unfrequently named granulators. In Jamaica they are mostly made of cedar, and are nine feet long by five feet at the top, and four feet at the bottom broad, and about 14 or 15 inches deep.

One of this size will contain a ton of sugar, and requires six *large* or seven common skips of sugar to fill it. Four coolers are on most estates allowed to each set of boilers, as I have shewn in the sketch. If made in India or elsewhere, good sweet wood is to be chosen, where cedar is not to be had. White pine is a very proper wood, and will impart no bad flavour to the sugar, as many common woods are liable to do. The pieces require to be $2\frac{1}{2}$ inches in thickness, and will require no metallic lining whatever.

Having thus taken a passing notice of the general *arrangement* of the boiling-house, I will now descend to the neces-

sary particulars, comprised under the head of "*hanging*" cyphons, boilers, &c., and endeavour to convey as clear an idea of the subject as its importance demands. The cyphons or clarifiers should have nothing to do with the flue of the boilers, but be entirely distinct, and have each their own separate fires. So simple and so small is the fire necessary for the clarifier, that fire bars are *not* required, or indeed anything but a basket-full or two of dry-cane-trash, doled out by the handful, as it burns away. I cannot bring to my recollection ever seeing fire bars used under a clarifier in the West Indies. A sufficient space for the fire beneath, and a flue connecting with the chimney, is all that is necessary. It must be remembered, that a gentle heat only is wanted to cause the liquor to "yaw:" no ebullition whatever is to be allowed, therefore the fire does not require that draft of air, which would call for fire bars and an ash pit. I cannot, however, forget having been shewn by a friend in this country, a couple of clarifiers in his boiling-house. These vessels were hung over a furnace of singular construction, and by the very large and fierce wood fire which was beneath them, I fancied their contents would speedily be brought to the boiling point, but no! they never advanced beyond the simmer. Whilst wondering at this apparent phenomenon, my friend pointed out to me a very broad chimney and a few dampers, which he had in the most ingenious manner possible arranged, so as to allow of three-fourths of the heat escaping up the chimney; whilst the remainder served to keep his clarifiers at the simmering point!

These clarifiers are always that height above the boilers, as to permit of the clarified liquor being drawn down by a cock, which is soldered in at the bottom.

"The Boilers" require great care in hanging, that they may boil quickly, and with as little consumption of fuel as possible.

I before stated, that dry-cane-trash was used in the boiling-house furnace, and also, that cane trash was for the cane-

plant the most valuable manure possible; it is therefore evident, that the greater the quantity that could be spared from the boiling-house for that purpose, the more abundant and rich would be our stock of manure. It is then an object with every prudent planter to economise his fuel as much as possible, to which end he must particularly look to the situation of his boiling-house. In parts up-the-country where the wind blows usually either from the east or west, it will be advisable to have the building *running east and west,* in order to ensure a good current of air for the furnaces.

In sketch No. 1, shewing the wind, cattle, and boiling-houses, the *stock-holes* will be found at the *back* of the boiling-house, which are thus placed for the purpose of securing a proper proportion of heat to the taches which they would *lose* to a great degree, by having the fire in a line with the flue under the boilers; as the draft would cause the fire to pass the tache and strike directly on the 2d tache or 3d evaporator. I know that it is a common practice in Demerara, and some other parts of the West Indies, to have the *stock-hole* in a direct line with the boilers; but it is a plan long since discontinued in *Jamaica,* and in my opinion deservedly so, the other being far more advantageous in many respects.

Having a good current of air secured by position, it next depends on the skilful disposition of the mason-work, to render the draft of air effective. This can best be managed by having small check works running across the flue, (generally denominated "bridges," see B. B. B. in engraving,) over which the flame and heated air are obliged to rise, and thereby made to strike against the bottom of each boiler in succession on the passage to the chimney. These "bridges" must be built with good fire bricks and mortar, and situated a little distance beyond the archway, (as represented.) The arches also must be carefully built, and made to vary in size as they approach the chimney; that of the 3d evaporator being two feet broad, the 2d twenty inches, and the 1st sixteen inches.

The furnace bars should be about two and a half or three feet below the bottom of the tache, to allow full space for the flame to strike with effect on it; and in all cases where the stock-hole is made at an angle with the line of boilers, the furnace should extend a foot or two on the side furthest removed from the 2d tache, to counteract the effect of the draft which would draw off the heat and flame too quickly towards the 2d tache. Immediately beyond the 1st evaporator, a damper should be placed, which being shut down, and the furnace door opened, damps and extinguishes the fire under the tache, and admits of the skip being struck without that great risk of burning, so observeable in boiling-houses unprovided with dampers. Under each of the evaporators, a communication must be allowed by a small arched space being left in the back wall, large enough to admit a boy or small man, who cleans out all the ashes which accumulate there.

When the boilers are laid, the divisions or saddles are brought up sloping, and neatly plastered; over which sheet lead or fine well-burnt flat tiles are laid, so as to protect entirely the plaster work, which would otherwise be soon eaten into, and destroyed by the hot liquor and syrup continually working on it. In Jamaica sheet lead is always used, but in Grenada and other islands, I understand that the tiles are substituted with great success. A friend of mine informs me, that when a little more than *ordinary care* is taken in moulding the tiles and fitting them in their places, they really answer admirably, and present a very pleasing appearance, always keeping bright and clean.

Nor is this all, they will, when properly treated, last for years, without requiring anything more than the substitution of a new one here and there, in lieu of those that may become fractured.

In India this is no small matter, as sheet lead is so very expensive, and even difficult to be obtained in many parts of the country; whereas excellent tiles are at all times, and in

most places to be procured from the natives. The same kind of clay of which they make the round tiles for houses would suit extremely well for the boiler tiles, only perhaps, they would find it worth their while to bestow a little more pains in working it up.

The most appropriate thickness I should imagine, would be three-quarters of an inch ; all the sides and edges must be extremely smooth and even, to allow of their lying perfectly close together, and each tile may be *sawn* into its necessary form, instead of being chipped by a mason's hammer *(bassoola)* or trowel, as a saw would accomplish the purpose in a more nice and even manner. This use of tiles instead of sheet lead for the slopes of the boilers, is worthy of the East Indian sugar planter's particular notice and adoption. The material is simple, well adapted, always obtainable, and in cost not exceeding a few rupees, all which, if taken together, is quite sufficient to recommend them.

It has been the common practice to hang the boilers as above described; but I imagine that *another* plan can with very material benefit be brought into practice. The difference which exists between the two, are in the *form* of the boilers and the *arrangement* of the flues. Say boiling pans five and three quarter feet long, three and three quarter feet wide, and two feet deep, (to allow for boiling room,) and bottoms slightly convex. In figure 6, a sketch is given of a set of boilers, which would be capable of doing a great deal of work. The fire after passing from the concentrating tache to the 2d tache, is then conducted by a flue under one part of the evaporators to the others in succession, and passing round the centre wall, returns under the other part. In adopting this method, it would be of course necessary to have *two* arches under the saddle of each boiler. I am well persuaded in my own mind that this plan would succeed admirably, and if any improvement is to be made in it, I think it may be by having *two* division walls under the boilers, so as to oblige the flame and

heated air to traverse the length of the six boilers *thrice*; that is, up and down and up again, by which means the heat would be almost entirely given to the boilers, instead of being lost by escaping up the chimney. In Jamaica, we often have a sheet of flame issuing even from the very highest boiling-house-chimney-top, which certainly seems to bespeak a very great loss of heat, which by the proposed plan, would be made available: add to this, the very small height of chimney, which would be necessary; for with *one* division wall, the length from stock-hole to chimney entrance would be sixty-two feet, and if *two* division walls, then eighty-eight feet, either of which would be a very tolerable length of flue, and would consequently need only a low chimney.

One other advantage attendant on this method would be the smaller size of the boiling-house.

A building, forty feet long by twenty-five broad would suffice for the boilers and coolers; whilst a shed *roof* thrown from the back wall, would answer well for the clarifiers and cold receivers; it might be, say twenty-five feet long by twelve feet wide.

Another *still* greater improvement might be made in the boiling-house, especially if the boilers were of the form just mentioned, and the flues arranged on the same plan. This improvement would consist in having a small *"vacuum pan"* attached to the evaporators and 2d tache, thereby leaving out the tache altogether. The evaporators would receive the liquor from the clarifiers, and would clean and evaporate it, until it reached the 2d tache, where it would be brought to the consistency of thin syrup, and be then transferred to the vacuum pan for concentration. When I say a vacuum pan, I do not allude to those expensive machines which are becoming common here now: but to an affair of far greater simplicity and cheapness. *One-tenth* of *their* expence would be more suitable to my views, and as I have taken the matter in hand, (in connection with a friend,) for the purpose of

proving to demonstration the correctness of my ideas on the subject, I hope soon to have the pleasure of introducing them to my brother planters.

A great number of vacuum pans are, I believe, used in Demerara boiling-houses, and the out-turn of sugar made by them is spoken of as being very superior. It has even been said, that formerly the produce of many marshy estates was far worse than the inferior *khars* of the Calcutta market; but that since the introduction of vacuum pans, this defect is entirely remedied.

There is no doubt whatever existing in my mind as to the propriety of boiling sugar cane syrup in vacuô; a larger quantity, and finer quality, will always I believe be produced by them, than by the open taches. The great expence, &c. &c. alone keeps them in the back ground. Simplicity and economy are the order of the day, and this will serve to keep the open pans at work for some length of time yet to come.

Whilst in London, a gentleman kindly presented me with a description of a set of coppers or boilers on the most approved Demerara plan, capable of making six hogsheads of sugar per diem; which plan I take the opportunity of subjoining, *as it may be interesting*.

"The coppers are five in number, and two taches. The size and dimensions are as follows:—

"Two taches containing 75 gallons each, three feet and seven inches wide at the mouth, and twenty-two inches deep. First copper or evaporator, to contain 300 gallons, six and a half feet wide at mouth and thirty inches deep. Second copper to contain 350 gallons, six feet and three quarters wide at the mouth, and thirty-one inches deep. Third copper to contain 400 gallons, seven feet and one and half inch wide at the mouth, and thirty two and half inches deep. Fourth copper to contain 450 gallons, seven feet and a quarter wide at the mouth, and thirty-two and half inches deep. Fifth copper to contain 500 gallons, seven and a quarter feet wide at the mouth, and thirty-six inches deep.

"The whole to contain 2150 gallons. The two taches might be made of copper, as also the second tache, (or copper next to the tache,) as they are very liable to crack when made of cast iron.

"The distance between the outside of the tache and the outside of the grand copper is forty-three feet and three inches. The outside of the fire mouth,* seven feet from the side of the tache, and the grating bars are thirty inches below the bottom of the taches.

"A coping or fence wall, rising with an incline, so as to make the flame strike on the side and bottom of the tache. The grating bars are four feet long, with three inch rests on each bearer, and they occupy in width two feet and ten inches. The width between the bars at the top two inches, and as the bars taper away in the bottom, there are two and a half inches.

"The ash pit is so formed, that the mouth comes out between the two *fire mouths*. The size of the iron fire mouths are twenty-two inches wide on the outside, and fifteen inches inside, and the heights from plates outside twenty-four inches and inside fifteen inches. The top is a semicircle.

"The stock-hole runs in size from twelve feet wide by ten feet long, to twelve feet wide to eighteen feet long. A brick arch covers it, so as to make it fire proof, and paved on the top of the arch. A cleaning hole, about two feet wide and two and a half feet high, runs under each copper, and through the back wall of the boiling-house. This distance between the coppers and the chimney is not material, say twenty to thirty feet, or less; but care must be taken to make the flue large, not less than five feet high, and two and a half feet wide. The chimneys are from eighty to one hundred feet, and the flue in the bottom six feet square, and at the top about three or four feet. The flue from the clarifiers comes in about the copper flue, and they ought always to enter in the same direction,

* This position of the fire mouth or stock-hole has been before noticed, and must plainly shew the policy of having it placed as I have recommended; viz. at right angles with the line of draught.

and on no account to be at right angles with, or opposite to, the copper flues, as it materially injures the draught. It is also necessary, where there are two taches, to have a *dipper*, and the valve at the bottom not to be less than twelve inches diameter.

"The dipper is raised by a gib or swing crane to reach both taches. There is a sluice door to each tache from first copper, made of copper and soldered, and built in this saddle, to charge up the taches when dipping.

"The flues round the coppers ought gradually to increase in size as they approach the chimney, and a damper may be placed behind the coppers."

I would observe in reference to this plan, that it is one of rather an ancient date, as I should imagine; from so many faults being apparent throughout.

I cannot here spare the space necessary to point out the various errors, although, I dare to say, that they will become apparent, even to the most careless observer, after looking over the foregoing detailed methods. Only two observations I will notice; viz. with respect to the flues of the clarifiers being at right angles with the flues of the boilers, and the necessity of a dipper. I cannot perceive that the flues of the clarifiers (their mouths being closed) can in any way injure the draught of the boilers, or even when a couple or more of the former *are working*, for the draught of the boilers up the chimney is so very great, that it could be affected in but a very slight degree, indeed, if at all. Such at least I have always found to be the case with myself. The necessity of having a dipper is not so great as is its expediency. I have seen many sets of coppers as above described with two taches worked without any dipper; but I am of opinion, that it is a very expeditious and desirable mean of emptying the taches, and one which does away with a great deal of mischief, such as discoloration, consequent on burning, &c. &c.

The native boiling-houses are as simple and cheap in their construction and material, as they are dirty and confined.

One of these houses, on a respectable scale, will have perhaps two ranges of earthen pots, (running parallel and quite close to each other,) hung over *one* flue, with one or *two* sheet iron boiling pans at the extremity, under which the fire is made. These ranges of earthen pots often consist of twelve to each range, and the cane liquor passes from one to the other in succession, as it boils down, until it reaches the iron pans or taches, where it is concentrated to the pitch they require, under the names either of "Goor," "Rhob," "Bhâlee," or "Doorsa," &c.

These edifices are long and narrow, entirely built with mud, and tiled roofs, to prevent accidents by fire. The boilers, both earthen and iron, are supported and divided by walls and partitions of mud, which by being well worked up and kneaded, becomes highly plastic, and forms a structure which generally lasts some length of time, and answers the purposes intended tolerably well. Nothing can possibly be conceived more simple or more cheap, than this rude and ancient method; it may be, and is of necessity very slow in its working, but when we consider the nature of the country, the character, prejudices, and extreme poverty of the natives, cultivators of the soil, locally named "Ryots," we must be struck with its excellent adaptation to the circumstances of their situation and national character.

Their boiling-house, rude as it is, is not subject to other, than a mere momentary disarrangement; for even if one of their earthen pots should crack and become leaky, the liquor contained is immediately ladled out, the pot removed, another substituted, and a little clay plastered round it, at once remedies the matter and sets all right again. The cost of the earthen pots ranges from two to four pice, according to the part of the country, so that at the latter price a whole double set of twenty-four pots would only amount to one rupee and eight annas ! ! ! ! The iron pans are made of sheet iron, and are very shallow vessels indeed: their cost ranges from ten to twenty rupees, and from that to forty

rupees; taking twenty rupees therefore as the average cost of those most in use, forty rupees would provide two, which with the twenty-four earthen pots, makes the sum of forty-one rupees and eight annas; add to this a few simple scummers and basket ladles, with a *kummul* (blanket) or two for straining, &c. &c., and a dozen or two of spare pots in case of breakage, &c., and we shall find 50 rupees amply sufficient for the whole. The whole of the buildings necessary for this large manufactory, could, in many parts of the country, be erected in fine style for 100 rupees, (one hundred rupees); that is, a boiling-house sixty rupees, and curing-house forty rupees, which is a bountiful allowance where wood and grass are plentiful.

Some of these manufactories are however *far smaller*, and decrease in size and importance, until we come to the poor dilapidated hut, with its two or three pots only.

This very confined scale of operations is far more general, than the comparatively grand affair above detailed. A Ryott must be a very rich man (in his own way,) before he could have the hardihood to *imagine*, much less carry out, such extensive operations. He must therefore provide himself with a few pots, and if he can, by hook or by crook, manage to possess himself of an *iron boiler pan*, he with the aid of a little mud, &c., soon erects his humble little manufactory, and then sets to work with laudable patience and perseverance (if not with industry,) to take off his own, or his neighbour's crop, as the case may be. In the latter event, he is compensated for his labour, skill, and the use of his apparatus, by having a small portion of the manufactured article allowed to him as *his* share. But in either the one case or the other, he always strives to manage matters so, that he may get through his work with the very least possible trouble, fatigue, or expence to himself. It is altogether opposed both to his national and individual principles and prejudices, that he should exert himself in the *slightest* degree beyond what is *absolutely* necessary and unavoidable. Therefore these small native manufactories are seldom otherwise than dirty, and even nasty, whilst

their produce very frequently bears incontestable evidence, that honesty forms no part of the manufacturer's character.

In Dr. Hamilton's Survey of Dinagpore, &c. we have the following account of the buildings, &c. &c. necessary in a native manufactory of sugar :—

"The boiler is sunk in a cylindrical cavity in the ground, which serves as a fire-place, so that its edge is just above the floor of the boiling-house.

"The fuel is thrown in by an aperture close to one side of the boiler, and the smoke escapes by a horizontal chimney, which passes out on the opposite side of the hut. Some manufacturers have only one boiler, others as many as four ; but each boiler has a separate hut, in one end of which is some spare fuel, and in the other end some bamboo stages, which support cloth strainers that are used in the operation. This hut is about thirty-six feet long, and fifteen feet broad, it has mud walls about nine feet high, its floor is about a foot and a half from the ground. Two other houses are required for each boiler, one for draining the molasses from the *goor* previously to boiling, the other for curing sugar."

This description will be seen to relate to a boiling-house for boiling *goor* into sugar, instead of the raw cane juice from the mill.

However, as all the boiling-houses are so nearly alike, this may be taken as a correct account of them as they are in that district ; the only difference being, perhaps, the presence of a greater number of iron boilers instead of earthen pots.

On an estate constructed on the West Indian principle, it would be necessary to have one or two buildings, named trash-houses, for the reception of the cane stalk or trash, after it has passed through the mill. Previous to putting it into the trash-house, it is customary to spread it out in the yard to dry, after which it is stored up for fuel. But in rainy weather, the trash is taken by the "*green-trash-carriers*" at once to the trash-house, where it steams until all the moisture has evaporated and the trash become dry.

They are usually long and narrow buildings supported on pillars, sometimes one hundred feet in length by twenty-five in breadth. The roof, which is of light construction, is always tiled, to lessen the risk of its being fired by a spark from the boiling-house or elsewhere. They are built some distance apart from the other houses for safety.

Their height is about twenty feet, and the cost is very small; they are of great service to an estate, and preserve the trash, dry, from one crop to another. On emptying a trash-house, a great quantity of very small pieces of trash will be realized, which have been broken and disengaged from the larger and long pieces: sometimes it lies at the bottom, to the depth of one, two, or more feet.

This crumbling or dust, (as it is sometimes named,) is all carefully collected, and taken to the cattle pen, where it is well trodden in, and becomes incorporated with the other substances, greatly adding to the quantity as well as richness and virtue of the manure.

As dried cane-trash is like so much tinder, no person should be permitted to approach the trash-houses with fire; for the whole estate runs the greatest risk of being burnt down, and the proprietor ruined. Even at this time I cannot look back at the conduct of the negroes in this respect, without absolutely feeling a thrill of dread run through me. It is wonderful, indeed almost past wonder, the very few accidents, that did really occur from this cause, especially when we reflect on the obstinacy and don't-care rashness of the old women, ("*digging*" dry trash for the dry-trash-carriers) and a number of others, rogues and vagabonds, who when out on nightly prowl, made the trash-houses their resting, as well as hiding place. Frequently I have discovered fellows lying fast asleep with pipes in their mouths, from which the coals had fallen down on the trash, or next morning seen traces of their visit by the fire sticks, &c. &c. which they left behind them.

I do not think the natives of India are a whit more careful or less indifferent in this respect. In fact, I doubt much if the danger is not greater with them, than with the negroes.

"The *Curing-house*" receives the new sugar from the coolers in a granulated form, and must therefore be built and fitted up in a manner which will best conduce to the curing of the sugar, and entail least expence in carriage, &c. &c.

In order to compass this desirable end, I should recommend for adoption the plan given in the sketch, shewing the curing-house to be adjoining the boiling-house, and immediately above the still-house.

By this arrangement, the only labour entailed is the carriage of the sugar from the coolers to the curing-house, where it is deposited either in hogsheads, casks, cones, or curing-boxes, as will be more fully treated of hereinafter. This removal of the sugar is termed "*potting*," and men are always appointed to this work, chosen from amongst the common labourers.

As sugar takes some length of time to cure, it becomes necessary to appropriate a large space for this purpose, and as the quantity which accumulates is sometimes very large, it is requisite to have a strong and substantial building.

The curing-house partially shewn in the sketch, is supposed to be eighty-four feet long by forty feet broad, which will be found sufficiently capacious I imagine. It must be always kept as warm and dry as possible, in aid of which *glass-windows* are extremely desirable, not only on this account, but because they admit light; an *abundance* of which, is most indispensably necessary. Damp, cold, and darkness should never be allowed to prevail in a curing-house, and indeed never can be, except by the violation of all just rules and principles.

As the curing of sugar and the necessary utensils employed, properly belong to the manufacturing department, I shall defer a further mention of the curing-house until we come to treat on that subject.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. VIII.—1843.—Vol. II.

Practical Remarks on the culture and preparation of Senna in the Bombay Presidency. By Dr. Alexander Gibson, *Superintendent of the Government Botanical Gardens at Dapooree and Hewra.*

To James Hume, Esq. *Honorary Secretary, Agricultural and Horticultural Society.*

My dear Sir,—I observe in one of your late numbers, an interesting paper by Dr. Wight on Senna cultivation. As I have now cultivated the plant rather extensively for three or four years, I can afford some information as to its culture, and answer in the affirmative several questions and conjectures made by Dr. Wight.

1st. As to the choice of ground. Dr. Wight is perfectly right in thinking, that the soils generally chosen for it in Tinnevelly are needlessly expensive. I find that it grows

quite as freely in poor alluvial soil containing much gravel. The only soil which I find adverse to its growth is the black soil, at certain seasons, as in the rains.

The land chosen should, if possible, be sloping, in order to prevent settlement of water about the roots, which kills the plant. Two to three ploughings I find requisite, and the more manure the better. The rotten stem of former crops I find to be the best manure of any.

2nd. *Sowing.*—This I prefer beginning with the first shower of the monsoon, as then the plant is, in a commonly good season, fit to afford a first cutting in September.

Hitherto I have always sowed with the common drill sowing machine in use among the people in these districts, and I believe in most parts of India; viz. the four hollow bamboos converging into a head and spreading below, so as to enter four hollow harrow teeth through which the seed drops.

The seed is sown as thick as grain, as the accidents of the season thin it afterwards. During the rains it will be found that at least three hoeings are requisite, and during the remainder of the year perhaps four more. This is the only expensive part of the culture. The cost of each hoeing may amount to two rupees and eight annas per acre. Supposing the plant to have grown well, advantage should be taken of the very first break in the weather, towards the end of August or beginning of September, to have a cutting for the leaves. It is important that this cutting should take place before the worm begins to make its attacks, otherwise you lose the whole of this cutting, and I have invariably found the worm blight come on earlier or later in September.

In cutting we cut the plant quite short, as was done by Dr. Royle, and thereafter give it a fresh hoeing. The plants will not again be ready for cutting before December, but this depends on soil, weather, &c. and between December, and the end of May two or three cuttings may be had. I have this year had (in gravelly soil) a very excellent second year's crop

from the same bushes, and the promise of them for the third year is good.

After cutting, the branches and leaves are put on a clean thrashing floor exposed to the sun. Thus they remain for thirty-six hours, covering them at night, in case there be dew, which invariably blackens them. When thus sufficiently dried, the bushes are beaten with small sticks to separate the leaves, but the leaflets hardly come away in quantity yet; the separating them from the mid-rib of the pinna is afterwards done. After this first separation they are transferred to the winnowers; viz. women with a winnowing tray or "soop," such as is used by the natives for cleaning grain.

By repeated shaking in these the leaflets separate, and such of the midribs as can be got rid of are removed by shaking to the front of the "soop," and then taken away. Still after this process very many minute fibres remain. These are carefully picked out by the winnowers, as it is important that not a single fibre should be left.

I find that one woman can turn out about 6 lbs. of dried leaf per diem.

The leaf thus cleared is packed in bags, and despatched to the medical stores.

From the above you will see, that Dr. Wight's conjecture as to the safety and superiority of sun-drying the plant is quite correct; it loses none of its active virtues.

That cut in thick weather I am obliged to dry in the shade, and in consequence, the leaf is exactly as described by Dr. Wight. I find that drying in iron pans, even without heat, turns the leaves quite black, therefore this should be avoided.

I have omitted to state, that in the course of the fair season I water the plant five or six times, but I incline to think that this may be unnecessary, as from its long root it can seek moisture for itself; and I have seen some which I had raised in a neglected unwatered spot (where however there had been a deposit of sheep manure) attain a height of four feet, and in

fact form a large bushy shrub, very different from my comparatively stunted plants of cultivation. I have got two or three natives to cultivate the plant, but from carelessness and want of weeding at the proper season, it has been by no means so profitable as that which I raise.

As to the return per acre, I calculate it as being annually in good soil about 500 lbs. I have this year tried a field sown on Dr. Wight's plan; viz. by holes, one and half feet apart.

Of the superiority of the sun-dried leaf another fact may be adduced. Dr. Royle mentioned that Senna, of quality equal to that produced here, could not be bought in London. Of this the reason I take to be that the value of the pure Tinnevelly Senna is deteriorated by the shade-drying, and the Arabian, though well dried, is adulterated.

I take this opportunity of intimating to the Society, that I can furnish from the Government Garden at Dapoorie, a number of rooted plants of the box-leaved olive. Of the broad-leaved and *Redouté* the supply of rooted layers is not yet adequate to the demand for them here, but I trust to have by and bye a large supply; one plant of each I may be able to afford you in November.

I have, &c.

(Signed) ALEXANDER GIBSON,

Superintendent, Botanical Garden.

Hewra by Soonere, 1*st August*, 1843.

Report on the result of Experiments for the introduction of American Cotton and other Products into the Province of Behar. Communicated by E. C. Ravenshaw, Esq. *Commissioner of Patna.*

To J. Hume, Esq. *Secretary to the Agricultural Society of Calcutta.*

My dear Sir,—I have the pleasure to forward, for your information, copy of a letter, with its enclosure, from the Officiating Collector of Shahabad, 21st July, No. 125, giving the result of the experiments made by Mr. Field, for the introduction of the Mexican and New Orleans cotton into that district. The seed was furnished last year at my request by Dr. Spry, the late Secretary of your Society. The Mexican failed in every district, and the New Orleans has only partially succeeded. I planted some of the latter in my own grounds at Patna, on the 1st August, 1842, and it came up pretty well. In the beginning of October, when about six inches high, the plants flowered. In December the pods were ripe; and the cotton beautifully white. The plants flowered again more abundantly in April, and the pods were gathered in May; strange to say, they are now in full blossom again. Specimens of the cotton in a box marked No. 2, accompanies the box of Shahabad cotton No. 1, which will be forwarded by the next steamer to your address.* The produce of the second year will probably be much more abundant than that of the first, if the season prove favorable, as the plant will have become acclimated. I avail myself of this opportunity to acquaint you with the result of the trial of the other seeds forwarded to me by the Society.

Received on 26th June 1842, sown on the same day in
1. American Maize my garden. The produce very irregular, grains larger but few, and not all round the stem. Sixteen
2. English Grasses. kinds, sown in separate plots on the 29th June 1842, not one come up.

* These specimens have since been received, and transferred to the Cotton Committee.

Six cuttings in a gumlah, or pot, received per steamer in
3. Tapioca. June 1842, each planted separately about six feet apart, grew up rapidly, throwing out abundance of large multifid leaves. In November some were four feet high, forming very pretty looking shrubs; cuttings from these have taken root freely, and are now four feet high. The roots of the first batch were about six or eight inches long, when prepared according to the instructions furnished to me by Dr. Spry; the result was a powder very like arrow-root, but more glutinous and adhesive when boiled with milk. The Tapioca which comes from Europe is in grains, not in powder; but how the grains are produced I have been unable to discover, and shall feel much obliged if you can acquaint me with the process, as granular Tapioca is more agreeable to the taste than that in powder.

Arrow-root also thrives extremely well in this part of the country, and might be cultivated to any extent. The powder prepared from the roots is apparently quite as good as that which comes from England.

It may not be generally known, that the stones of the common sweet date* which comes from Egypt, and which is known here by the name of "*Pin khajoor*," will vegetate if planted in this country. I planted about twelve last cold weather, of which six have come up. They are however very slow of growth, and the first I think did not make its appearance above ground until about a month after it was planted.

As the natives of many parts of Egypt, Arabia, and Persia, are said to live almost entirely upon the produce of the date palm, it might, if cultivated in this country, afford a resource to the natives in times of famine or scarcity. A clump or small tope near each village would prove a living granary, from which the inhabitants might derive a subsistence when other crops failed. The date being of the order Diæcia, (*i. e.*

* The produce of the Phœnia dactylifera, or date palm.

the male and female flowers being on different trees,) it is necessary to their productiveness that they should be planted near each other. The date tree of India is of a different species, the "Phænia farinifera," which though it yields some edible substance, is chiefly renowned for the excellence of its toddy.

Yours faithfully,
(Signed) E. C. RAVENSHAW,
Commissioner.

Commissioner's Office, Patna, 25th August, 1843.

(Copies.)

No. 125.

From the Collector of Shahabad to the Commissioner of Revenue for the Division of Patna.

SIR,—Herewith I have the honor to forward the original Report, (copy having been kept for record in this office,) by Mr. Field, Sub-Deputy Opium Agent, on the result of the experiment to introduce American cotton into this district. This communication, together with eight parcels of cotton alluded to in Mr. Field's letter, are now forwarded by coolie, under the charge of Sheodeen, chuprassie.

2nd. You will learn with regret, that this interesting experiment has almost entirely failed, in some measure from the apathy of the native cultivators, and their prejudice in favor of old established usage; but chiefly from the very unfavorable weather which occurred in October last. I have just examined the plants now in Mr. Field's garden, and a more flourishing or splendid crop could not well exist. Should the weather continue favorable, it is to be expected that his report next year will prove highly interesting. The Mexican seed seems to have entirely failed, owing, I learn, to its having been received here in a damp and damaged state.

Mr. Field being a practical agriculturist, and his report full and detailed, I will not attempt to add any remarks of my own, my experience in such matters being very limited.

I have, &c.

(Signed) W. P. Goad,

Officiating Collector

Shahabad, Collector's Office, 21*st July,* 1843.

No. 12.

To W. P. Goad, Esq. *Officiating Collector of Shahabad.*

Sir,—With reference to the correspondence noted in the margin, I have the honor to report the result of the experiment entrusted to me by your predecesssor, to introduce amongst the native cultivators of this district, American cotton seeds.

Mr. T. Sandys, Collector of Shahabad to Mr. G. Field, S. D. O. Agent, No. 107, dated 7th June, 1842. The S. D. O. A. in reply, 9th June, 1842. The Collector to the S. D. O. Agent No. 111, dated 15th June, 1842. Do. do. to do. No. 151, dated 15th Aug. 1842. The Sub-deputy Agent in reply, dated 10th August, 1842. The Collector to the S. D. O. Agent, No. 152, dated 12th August, 1842. Do. do. to do. No. 153, same date. Do. do. to do. No. 139, dated 23rd August, 1842.

2nd. The accompanying tabular statement contains all the particulars required by the Commissioner of Revenue, in the form given in his letter to Mr. Sandys, No. 178, dated the 30th May 1842, and some others that appear to be necessary in consequence of the general failure of the experiment.

3rd. You will observe by the statement, that the seeds were distributed to the Quairees of all the thirteen Purgunahs of this district. They are the most industrious and the best practical agriculturists we have, and they all promised to sow the seeds, and regulate the cultivation precisely according to Mr. Mercer's rules that accompanied the Commissioner's letter above quoted, a Nagree translation of which was furnished to each of them when they received the seeds.

4th. The barrel of Mexican seed was received by me on the 15th, and distributed to the Opium Quairees on the 17th June. On the 13th August, the barrel of New Orleans seed was received. The weather was not favorable for sowing until the 18th August, about which time the native cultivators sowed the Mexican seed, and I had two plots of ground in my garden each three cottahs sown, one with the Mexican, the other the New Orleans seed. The former did not vegetate, the latter came up very regularly. Reports were received from all the Purgunahs, announcing the failure of the Mexican seed, on which I immediately sent out the New Orleans seed to the same cultivators, informing them, that the seed then sent had vegetated freely in my garden, and directing it to be sown in the same fields that had been prepared for the former seed. The New Orleans seed came up everywhere, and continued to thrive until the heavy rains that fell during the Hutteah Nuchutter, which set in on the 25th September, and this weather being followed by the gale on the 5th and 6th October, the young plants began to sicken, the leaves turned black and fell off, and the plants themselves gradually died off.

5th. In my own garden, the plants were very sickly, and many died, and were replaced by others from fresh seeds. Those first sown were in flower about the middle of October when only a foot high. In November, some pods were well formed, which produced cotton in January; but the greater proportion produced in that and the following months never came to maturity, but fell off before they opened. In March, April, and May, produce was collected at first inferior, latterly very good: since the middle of May, a great and unexpected improvement has taken place. New green leaves were put forth, and the plants sprung up and became fine bushes, and there is at present every prospect of the next year's crop being an abundant one. The plants have not produced cotton since May; but they continue, as they have been from the first, covered with flowers, and pods are forming for another crop.

6th. Accompanying I send eight parcels of Cotton. Nos. 1, 2, and 3 are samples of the produce of my own garden. Nos. 4 to 8 of the produce of the native cultivators' fields. You will observe, that the quality is greatly superior to that of the cotton produced from native seed, of which latter, the proportion of seed to the cotton is much larger. That of the cotton produced from the New Orleans seed, the produce of my garden, is about 160 lbs. per acre, but I have no doubt the second year will produce much more. The produce of native seed is from 6 to 800 lbs. per acre in the best descriptions of soil.

No. 1. The best cotton cleaned from the seed.
No. 2. The best cotton produced in April with the seed.
No. 3. The produce in February and March 1843.

7. This experiment may be considered a failure, caused in a great measure by the unfavorable weather experienced shortly after the seeds were sown; more might perhaps have been effected under the circumstances, had I had the co-operation of cultivators less apathetic than the natives of this part of India are, who look upon change in any form or any departure from long established usage, as innovation. They prepared the land and sowed the seed, and there their efforts ceased, being thoroughly convinced, the failure was entirely owing to the *abb howa,* or climate being uncongenial.

8th. I shall have the honor to communicate about this time next year, the result of next year's produce from the few fields remaining.

I have, &c.
(Signed) G. Field,
Sub-Deputy Opium Agent.

Shahabad, S. D. O. Agency, 18*th July,* 1843.

Return required by the Commissioner of Revenue, shewing the result of an Experiment to introduce American Cotton Seeds into the Shahabad District, vide his Letter of the 30th May, 1842, to the Collector of Shahabad.

Pergunah.	Mouzah.	Names of Cultivators.	Quantity of land sown.	Quantity of land that failed totally.	Quantity of land producing crop.	Quantity of seed sown.	Quantity of seed cotton produced.	Description of soil.	Average produce from native seed on the same quality of soil.	REMARKS.
Arrah,	Nawaddah,	Mr. Field,	0 12 15	0 0 0	0 12 15	0 1 4	0 31 0	Garden, reddish clay mixed with sand.	... ...	The produce is much superior in quality to the produce from the native seed. The crop was irrigated.
Ditto,	Mussar,	Nurrotim Quoiry,	0 5 0	0 5 0	0 0 0	0 0 8	0 0 0	Reddish clay.	... ...	Sown first with Mexican, then with New Orleans seeds, the former did not vegetate, the latter came up regularly; but the plants died shortly after the gale in October.
Ditto,	Nawaddah bane,	Ramnath Quoiry	0 5 0	0 5 0	0 0 0	0 0 8	0 0 0	Ditto.	... ...	Ditto ditto ditto.
Barragonah,	Muhooree,	Kunnyah ditto,	1 0 0	1 0 0	0 0 0	0 [illegible] [illegible]	0 0 0	Light sand and clay.	... ...	Ditto ditto ditto.
Ditto,	Bhugwuntpoor,	Bickarry ditto,...	0 5 0	0 0 0	0 5 0	0 0 8	[illegible] [illegible] 0	Ditto.	... ...	Irrigated: the gale in October 1842 nearly killed the crop.
Ditto,	Ditto....	Juggernath ditto,	0 5 0	0 0 0	0 5 0	0 0 8	0 2 4	Ditto.	... ...	Ditto ditto ditto.
Bherah,	Simraon.	Retoo ditto,	0 10 0	0 10 0	0 0 0	1 0 0	0 0 0	Reddish clay.	... ...	Sown with both seeds, the Mexican did not vegetate, the plants from the New Orleans were destroyed by the gale in October.
Ditto,	Esaury,	Ramdhun Ditto.	0 10 0	0 5 0	0 5 0	0 1 0	0 17 0	Ditto.	... ...	Irrigated, crop promises well for 1843—44.
Nanore,	Kowladhurij,	Sirry Kishun,	0 10 0	0 6 0	0 4 0	0 1 0	0 10 0	Ditto.	... ...	Ditto ditto ditto.
Ditto,	Burroohee,	Bajn Quoiry,	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Total failure.
Pawar,	Pawnah.	Shew Churn Do.	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto ditto.
Ditto,	Oodouwuntnuger	Bukus Quoiry,...	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Total failure, the Mexican seed did not vegetate, the plants from the New Orleans were killed by the gale of October, 1842.
Dunwar.	Ghoseah,	Gunga Quoiry,...	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto ditto.

Return required by the Commissioner of Revenue, shewing the result of an Experiment to introduce American Cotton Seeds into the Shahabad District, vide his Letter of the 30th May, 1842, to the Collector of Shahabad.—(continued.)

Pergunah.	Mouzah.	Names of Cultivators.	Quantity of land sown.	Quantity of land that failed totally.	Quantity of land producing crop.	Quantity of seed sown.	Quantity of seed cotton produced.	Description of soil.	Average produce from native seed on the same quality of soil.	Remarks.
Dunwar, ...	Arrung, ...	Gungah Bhugut,	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Reddish clay.	... ...	Total failure, the Mexican seed did not vegetate, the plants from the New Orleans were killed by the gale of October 1842.
Dinnarrah, ...	Ukhorah, ...	RamsaheeQuoirv	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto.	Dhooeah, ...	Muhungoo ditto,	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Peeroh, ...	Bhoolkhoaah, ...	Shewsahae ditto,	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto, ...	Petturroo, ...	Ramsahae ditto,	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Bhojepoor, ..	New Bhojepoor,	Deenah ditto, ...	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto, ...	Ahthur, ...	Jhunuk ditto, ...	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto, ...	Dukhunow, ...	Munbode ditto,...	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto, ...	Kaisuth, ...	Lutchmun ditto,	0 10 0	0 10 0	0 0 0	0 1 0	0 0 0	Ditto.	... ...	Ditto ditto.
Chinepoor, ...	Nussaige Khass, .	Ramchurn ditto,	0 5 0	0 5 0	0 0 0	0 8 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto, ...	Khulaspoor, ...	Shew Churn ditto,	0 10 0	0 10 0	0 0 0	1 0 0	0 0 0	Ditto.	... ...	Ditto ditto.
Ditto, ...	Hurrihurpore ...	Shew Sahae ditto,	0 5 0	0 5 0	0 0 0	0 8 0	0 0 0	Ditto.	... ...	Ditto ditto.
Saperam, ...	Saperam, ...	Shah Kubbeeroodeen, ...	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	Ditto.	... ...	Not reported.
Ditto, ...	Dowdaur, ...	Pultoo Quoiry,...	0 5 0	0 5 0	0 0 0	0 8 0	0 0 0	Ditto.	... ...	Total failure.
Ditto, ...	Deeh[illegible] ...	Nirdharry ditto,.	0 5 0	0 0 0	0 5 0	0 8 0	0 1 9	Dhee Tickrour Elevated land, the site of a former village.	... ...	Irrigated, very poor crop, plants dying, no prospects of their living.
Rhotas, ...	Busdeeah, ...	Phoondu Quoiry,	0 5 0	0 5 0	0 0 0	0 8 0	0 0 0	....	... ...	Total failure.
Ditto, ...	Shahpoor, ...	Bhugwan ditto,...	0 5 0	0 5 0	0 0 0	0 8 0	0 0 0	....	... ...	Ditto ditto.
Chownseh, ...	Chandpoordeera,	Nerunjun ditto, .	0 10 0	0 10 0	0 0 0	1 0 0	0 0 0	....	... ...	Ditto ditto.
Ditto, ...	Pursotimpoor, ...	Udjoodeah ditto,	0 10 0	0 10 0	0 0 0	1 0 0	0 0 0	....	... ...	Ditto ditto.
			13 12 15	11 16 0	1 16 15	0 29 4	1 24 16			

Shahabad, S. D. O. Agency, 18th July, 1843.

(Signed), GEORGE FIELD, S. D. O. A.

(True Copy,)

THOMAS B. WHARTON, *Assistant to the Commissioner.*

Correspondence relative to a Black Vegetable Dye, procured from the Shan country, by Messrs. A. H. LANDERS *and* WILLIAM WARWICK. *With a report thereon by Dr.* MOUAT.

To J. M'CLELLAND, ESQ., *Calcutta.*

MY DEAR SIR,—I have much pleasure in being able to send you a few specimens I brought with me from Zemmie, the capital of the Shan country, situated in about lat. 20° N. long. 100° E.

I shall feel much obliged by your placing the silk, hemp, grass cloth, and the black vegetable dye, before the Calcutta Society. The hemp you will perceive is of a very superior description, and the black vegetable dye is purely a vegetable substance, and manufactured by myself after the manner of indigo, and I am led to believe is the first successful attempt of the kind. The Shans dye their cloth with the berry in the raw state. I have seen cloth dyed with the dye in question without any ingredient, and had been in constant use for several years without losing its color in the least; they sometimes, however, mix a small portion of iron filings to give an additional hue, and at other times lime, according to their fancy.

The berry is produced from a small tree, or rather shrub, from two, three, or six feet high, and is to be got in abundance between a place called Min-out and Zemmie, during all the cold season, (see the accompanying sketch.) The Shans inform me, that the tree is indigenous to that part of their country only, which I readily believe, because I found it nowhere else myself. Yours &c.

(Signed) A. H. LANDERS.

Moulmein, 8th April, 1843.

To CAPT. WM. MCLEOD, *Moulmein.*

I have the pleasure of sending you a specimen of the black dye. I made the experiment myself, and find it is produced from the pulp growing round a kind of plum, of a very light

colour inside, until broken, exposed to the air and sun, when it gradually assumes an intense black dye, and becomes insoluble in water, and must go through the same process as indigo, both being insoluble in water. The manner of dyeing silk is very simple; it is immersed in a quantity of the pulp mixed with water sufficiently thin, and either dipped or rolled over the silk, which immediately being exposed to the sun grows darker, and if not sufficiently dyed, this is repeated; it requires but a small quantity to dye a quantity of silk.

I shall bring down with me a piece of long cloth I have had dyed: the process of dyeing cotton is different; it is first put in a solution of indigo, dried, and then immersed and exposed to dry becomes entirely black. The natives keep the indigo in solution; with it is mixed a great quantity of lime; no boiling or hot water is used in the process. Should you have an opportunity, send the specimen to the Society in Calcutta in my name, and I will bring a box down to be sent to England, as well as some indigo; and inquire of them if there be any premium for the production of a black dye that requires no sulphate of iron.

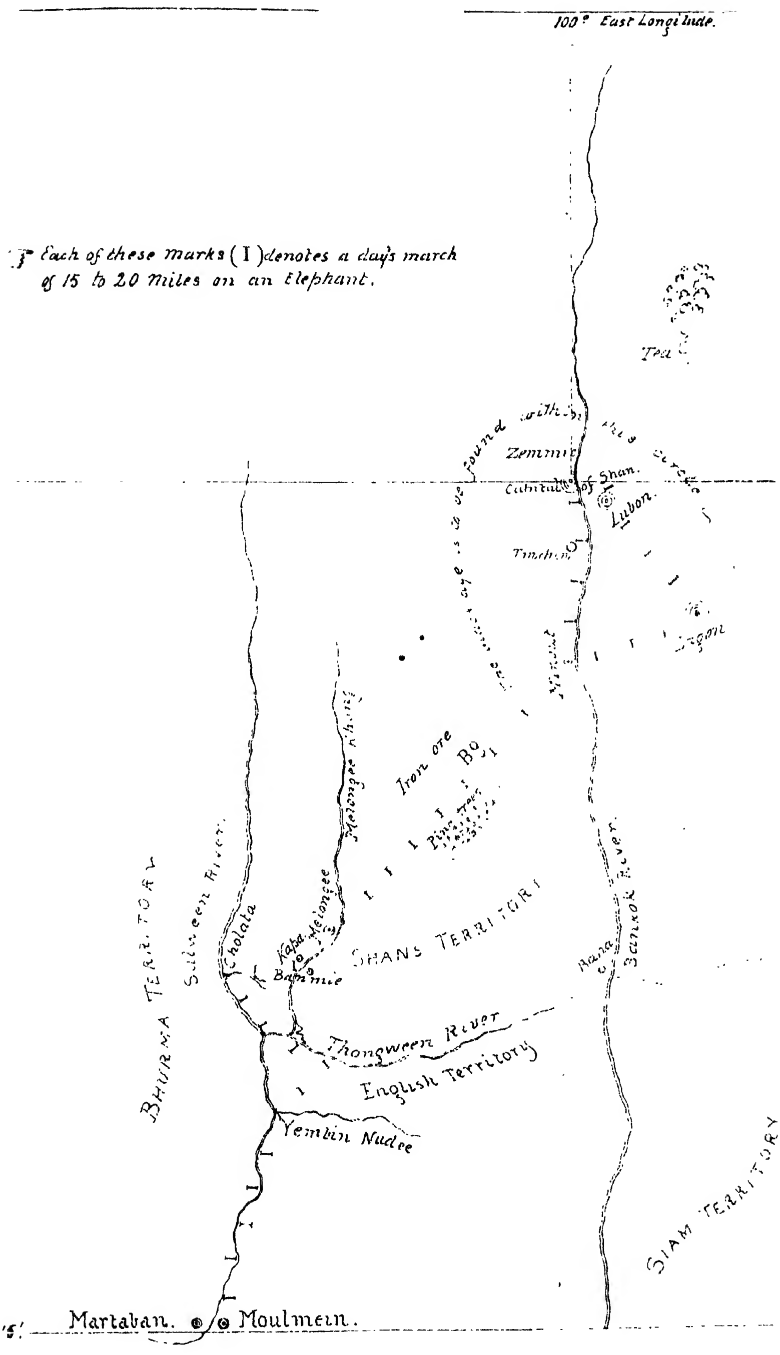
(Signed) WM. WARWICK.

Zimmay, February, 1843.

To JAMES HUME, ESQ., *Honorary Secretary, Agricultural and Horticultural Society.*

SIR,—I have the honor to inform you, that in accordance with the wish of the Society, I have examined the specimens of the black dye, brought from the Shan country by Mr. Landers; but regret that my leisure has not been sufficient to enable me to perform as many experiments as I could have wished, to enable me to ascertain the exact chemical composition, and probable value of the substance.

It is of a jet black colour, extremely hard, and very refractory in its reaction with the most powerful chemical agents; sulphuric and nitric acids, with the caustic alkalies, having little effect upon it. It was found by my Assistant,


100° East Longitude.
Each of these marks (I) denotes a day's march of 15 to 20 miles on an Elephant.
Tea
Zemmie
Capital of Shan.
Lubon.
Iron ore
Shans Territory
Cholata
Bammie
Salween River
Burma Territory
Thongween River
English Territory
Yembin Nudee
Bankok River
Siam Territory
Martaban.
Moulmein.

Mr. Robertson, to contain a quantity of iron and earthy matters, the exact amount of which was not ascertained. It is not therefore a pure vegetable dye, and to produce any colour from it in its present state, it was found necessary to combine a deoxidating agent with it,and to subject it to processes similar to those used in dyeing with indigo, to which in many of its characters and properties it bears a strong analogy. If found in sufficient abundance, and procurable at a cheap rate, although not supplying the long-sought desideratum of a pure vegetable black, it may become a valuable commercial article. It would be more satisfactory, however, to obtain a specimen of the fruit of which it is stated to be the dried pulp, and subject it to careful analysis, to ascertain whether the iron has been subsequently mixed with it, or whether it is contained in the fruit itself, and if so, the state in which it exists there. If the Society could succeed in procuring the entire plant, and a portion of the soil in which it grows, the information to be derived from a chemical examination, would be much more complete and perfect. The great objection to it, in the form submitted by Mr. Landers, is the difficulty of reacting upon it, and imparting its colouring matter to any substance intended to be dyed with it, which does not appear from Mr. Landers' account to be the case, when the pulp is fresh and recently suspended in water. I am therefore of opinion, that it is a subject well worthy of further enquiry, especially as the specimen of cotton dyed with it, and presented by Mr. Landers, is of a fine jet colour, and would be much esteemed in the European market.

I have, &c.

(Signed) F. J. Mouat, M. D.

Medical College, September 11, 1843.

Memorandum on specimens of the Dyeing Lichens of Mauritius and Madagascar. By T. F. HENLEY, ESQ.

Read at the Meeting of the 13th September, 1843.

I have the pleasure to offer the Society a few specimens of Dyeing Lichens, the produce of Mauritius and Madagascar. The specimens from Madagascar are actually portions of the moss as collected and forwarded to Mauritius for commercial purposes, bearing a value in the London market of from 60*l.* to 70*l.* per ton. It is found abundantly in the forests of that island, adhering to dead and decaying trees, and not on rocks. To the latter point, its adherence to trees, I shall have to refer, when noticing the specimens from Mauritius. It will appear on viewing the specimens, that it is the same variety of moss as that collected in the Cape de Verdes, (of which I beg to forward specimens for comparison,) the latter being however, by all accounts, exclusively the produce of rocks. The colour obtained from this Madagascar Lichen is the deep claret.

Of the accompanying specimens of Mauritius Lichens, the only one producing a valuable dye is the specimen marked A. It is to be remarked, in reference to this variety of Lichen, that when collected from trees, it has not the property of producing the red dye, yielding merely the brown or fawn colour, and therefore considered of little or no value. The moss collected on the sea coast is much superior in shade to that found in the interior of the island. The fine amethyst dye, is alone produced from portions collected on the coast. Scarcely two specimens of the Lichen will be found to produce the same shade of colour, varying from the most beautiful amethyst hue to the deepest claret.

I have the pleasure to add a specimen of this variety of Lichen adhering to its native rock, and also one growing on a branch of a forest tree.

The specimen marked B, is likewise found abundantly attaching itself to trees, as well as rocks. It yields, however, only the brown dye, when treated in the ordinary way with alkalies.

The variety of Lichen corresponding with that procured from the Cape de Verde Isles, is also sparingly found in Mauritius. I have not a specimen however to offer; that most abundantly procurable, is that which I now present, marked A. It is believed to be of a very superior quality, and has been valued at 120*l.* per ton. The high rate and scarcity of labour in the island must, however, preclude its collection for commercial purposes.

The Sugar Planter's Companion.

By L. Wray.

[Continued from page 192.]

"The Distil-house."

The still-house, as represented in ground plan of Plate 2, is infinitely better arranged than any other that I can possibly imagine. I have seen hundreds of houses on a very different plan, and have even had the management of some few, but, when I came to work in a still-house similar to that shewn, I was surprised and delighted at the change; the ease and comfort wherewith every requisite labour was accomplished, together with the neatness and extreme cleanliness which reigned throughout, afforded a pleasing contrast to the old plan, with its antiquated "tuns," and various attendant annoyances.

To a person unacquainted with both systems, the great difference which exists can scarcely be conceived.

The chief points in which this difference consists are three; viz. the great expence of the fermenting tuns, the far greater expence and labour in working them, and their increased

liability to be influenced prejudicially by every slight change of the atmosphere. Many other reasons can be brought forward against them, but for the present the foregoing will suffice.

In Plate 2 it will be perceived, that the fermenting cisterns are sunk in the ground, also that the skimmings' receiver and molasses' receiver are both above the ground level, which enables the stillerman to draw down his skimmings and molasses into the cisterns merely by turning a cock, whilst the dunder receiver and condensing tank, can be so far elevated as to admit of the same easy transmission of their contents. Thus the only pumping which would be necessary would be when filling the still from the cisterns, (which one man can easily perform in about a quarter of an hour, supposing the still to contain 1,000 gallons,) and keeping up a good supply of water in the cold-water cistern, otherwise called the condensing tank. This latter must in any case be done, unless where water is *very scarce* ; it then becomes imperative to build a large tank, (for the still-worms,) capable of containing from 30,000 to 40,000 gallons, which is kept up pretty full by occasional showers, aided now and then by a supply from some neighbouring pond, &c. The water from such tank as this, could not be used for setting up your liquor, for two reasons ; first it would deprive the still-worms of the water requisite to the condensation of the spirit vapour, and secondly, the water would be far too warm to allow of its being suitable for that purpose.

The fermenting cisterns should be made of good seasoned wood. In Jamaica, cedar is chiefly used, but for this country, teak, saul, pitch pine, white pine, &c. are suitable ; the two latter especially, if procurable at a cheap rate in the form of planking. Teak perhaps is too expensive, and saul too liable to warp and become leaky.

They should be made to contain sufficient to fill the still exactly, or twice that quantity ; the former I think is preferable.

To construct these cisterns no coopers are needed, as any common native carpenter will answer well, they are so very simple and easily built.

The planks may be about $1\frac{1}{4}$ inch thick, and when the cistern is put together, it should be tarred on the outside with a mixture of grease, tar, and arsenic, which will effectually prevent its being attacked by white-ants or other insects, whilst it preserves the wood from rotting. The cisterns being all ready, spaces must be dug (in the intended still-house) to admit them, and a quantity of good dry clay be provided. They are then lowered into these spaces, (the bottom being properly prepared with clay, well beaten down,) and the sides are very carefully and strongly filled up with the clay, which must be tightly rammed down. The cisterns must be sufficiently far apart to admit of a man's walking conveniently between them, for the purpose either of mixing, cleaning, scumming, or pumping out their contents.

The scummings' receivers are built with wood, and (in Jamaica) always lined with sheet lead, as the wood uncovered would soon become so tainted as to turn acid all the fresh scummings which pass into them. It is therefore always proper to cover them either with lead, tin, zinc, copper, or even *very thin* sheet iron, which latter would answer very well, and at the same time be cheaper than the others. Each receiver must be provided with a brass cock, by which to draw down the liquor into the gutters, &c.

A space must be left in the wall which divides the boiling and still-houses, through which a gutter runs to convey the scummings of the boilers, clarifiers, &c. from the boiling house, into the scummings' receivers in the still-house.

The "molasses' receiver" is a large tun, (similar to those used in this country as fermenting tuns,) situated in the very centre of the still-house, and should be capable of containing from two to five thousand gallons. This receiver may be provided with two or more cocks to draw off its contents,

although simple plugs are very commonly used; but whether cocks or plugs, they should be placed about *one foot* from the bottom of the receiver, for if placed lower, the molasses often settles down thick, in the form of sugar.

The dunder receivers are two wooden vessels which receive the liquor or wash after it leaves the still, and when cool, passes it on to the cisterns in a tolerably clarified state.

They should be built so as to be immediately below the still, and yet sufficiently high, to allow the dunder to flow by the gutter into the still-house.

The cold water cistern in which the worms of the still or stills are immersed, varies much in respect to the supply of water which is available, and the form and size of the worms. Sometimes a small tun only is required, there being a large supply of water; again a moderate sized cistern may be called for, or even a large tank.

They are often of that elevation that the water can run into the still-house at once without pumping. If the supply of water be large and constant, they should always be so elevated, as to save labour, &c.

The can-pit is generally a small place, (rather below the level of the ground,) in which the cans are set to receive the spirit as it runs from the worm of the still. Plate 2 shews a part of the worm pipe passed through the back wall of still-house, and exhibiting itself in the can-pit. As these cans in turn become full of spirit, they are removed by the appointed attendant into the rum store, and their contents transferred to the rum butts.

The rum store should have four butts, (each capable of containing from 500 to 1,000 gallons,) raised on mason work or wooden horses to the height of about three feet from the ground, in order that the rum may be the more easily drawn off into puncheons or hogsheads when required. The remaining space in the rum store is mostly occupied by puncheons, hogsheads, &c. &c. either filled, or in readiness *to be* filled.

"*Stills and retorts*" are so exceedingly numerous and different to each other, that I will take notice of those only, which appear to be most in use, and likely to answer.

First, then, we have the old single still, into which the liquor or wash is placed, and the low wines resulting from first distillation being put into a low wine butt, accumulates until sufficient is realized to fill the still. The butt is then emptied of its low wines, and this being again distilled, *rum* is produced. But this is found a tedious method, which entails great loss of time, fuel, &c. therefore another still has been added which communicates with the other, forming something like a retort. After this, a still and single retort or rectifier came into use. This too was found objectionable in consequence of the ill flavour it generally produced, together with the low strength of the spirit which could best be obtained by it. "Corty's condensing still," manufactured by Messrs. Shears and Sons, is much used both in the West Indies and also here. I have seen some two or three at work in India myself, and heard them well spoken of. Porter says, many of these stills are used in the colonies, and especially in Tobago. We have been informed by a planter residing in that island, that by means of one which he has on his estate, the process of distillation, which formerly was one of the greatest labour and anxiety, has been "rendered of very easy accomplishment; that he is enabled to work the still five times in twelve hours, thus increasing the quantity of rum beyond what the common still enabled him to make, and that the rum is so much improved in quality, as to command an increased price in the island, equal to twelve and a half per cent."

This is certainly a very flattering account, to place against which I must in honesty state the opinion of an old and highly intelligent West Indian planter, a gentleman of great experience and observation, who says, "I have seen many of these stills at work, and have often marked their performance; they certainly work well and expeditiously, but the

spirit produced, is very far from that fine flavoured article, which by its peculiar aroma, distinguishes itself so much."

Next we have "Winter's still," manufactured by Messrs. Pontifex, Sons and Wood, of London, which is very generally known, although I have not myself had an opportunity of seeing any of them at work. Porter says, "a very satisfactory experiment has been made with this apparatus on an estate in Jamaica. 18,000 gallons of wash were divided into equal portions; 9,000 gallons were distilled in the old manner, first through a wash still, and then through a spirit still; the produce was 365 gallons of rum, 42 per cent. over proof, and the time occupied in the two distillations was 113 hours and 55 minutes. The second 9,000 gallons were distilled in Winter's apparatus, and in 105 hours produced at one distillation 410 gallons of rum, 52 per cent. over proof. The rum produced by this process is much finer and better flavoured than was obtained by the old system, and a considerable saving of fuel is likewise effected."

When Mr. Porter wrote this, such work may have been considered good, but from my own experience in Jamaica, I can scarcely imagine anything so preposterous. Even by this improved still, it would appear, that it took nearly nine days to distil about four puncheons of rum, and that too from 9,000 gallons of wash; whereas with a 1,000-gallon still and a couple of small retorts I have constantly produced 220 imperial gallons of rum, 30 over-proof, from 2000 gallons wash, in twelve hours: being, say 990 imperial gallons rum 30 per cent. over proof, from 9,000 gallons of wash in fifty-four hours.

But not to enter into an investigation of the quality of the wash *here*,—as that will be treated of at length in its place,—I will only mention, that I never heard, in Jamaica, of any still performing such bad work.

We have also the double still and single retort, which is worked by filling the liquor (or larger) still with liquor or

wash, and the smaller with low-wines, as also the retort; that in the latter, however, being rather stronger.* To expedite work, fire is made under both stills until they commence boiling, when the fire under the low-wine still is withdrawn, and the whole heat then proceeds from the one remaining furnace.

This description of still is in common use, works expeditiously, and produces rum of a fine quality. A friend of mine, who has one now at work, tells me, that he commonly gets in twelve hours, 500 gallons of rum, 30 over-proof. His large still contains 1000 gallons, and the small one 500 gallons: the retort being of the usual size.

A single still and double retort is a very complete and excellent arrangement of a distilling apparatus, and is indeed the kind of still that I have been most used to in my own work. A copper still of 1,000 gallons and two small retorts of about 80 and 70 gallons each, properly hung, and judiciously managed, should work off 3,000 gallons of wash during a day of twelve hours, which wash if set up moderately high, would perhaps yield 350 to 400 gallons of rum, 30 per cent, over-proof, when coloured.

I have used this still for years, and can therefore with great safety answer for its simplicity and efficiency.

The still is charged with wash, and the two retorts with low-wines, (say 40 gallons into the large and 30 into the small one;) the fire is then made under the still, and *rum of a fine flavour is produced at once.*

The cost in England of such still, with double retorts, worm, &c. &c. complete, would not be more than 450*l.* sterling; whilst the expedition and efficiency of its work, together with the purity of the spirit produced, speak loudly in favour of its general adoption.

I can only add two facts more in its favour; viz. that it is peculiarly adapted for the distillation of a very strong spirit, and that the rum which I made with it, (in Trelawny, a parish

* In the event of there not being sufficient low-wines to fill the small still, then wash may be put in until sufficient accumulates.

on the north side of Jamaica, famous for the excellence of its rum,) was of a most superior description, and accordingly commanded a very high price in the market.

They are now becoming very numerous throughout Jamaica, and are fast superceding the old and less efficient stills. As to the retorts, they can be very easily constructed, either of copper composition, sheet iron, or even wood; the latter material is by no means unfrequently used. I myself have seen dozens of them, and can see no reason why they should not answer the purpose perfectly well. Had I a common-single still, (being in India,) I should not for a moment hesitate in adding two wooden retorts, considering as I do, that they have the greatest possible recommendation; viz. simplicity, added to efficiency, cheapness, and safety.

For the interior parts of India this is no small advantage, when we remember how easily they can be made by any native carpenter; and with what facility, alteration, improvements or repairs, can be effected on the spot, and at a moment's notice.

The "steam still" as it is termed, has lately entered the field, and if the accounts of its performance be correct, bids fair to outstrip its predecessors.

I saw one on its arrival in India, which cost 1000*l.* sterling, and was said to be capable of producing 1,000 gallons of rum per diem.

I have also seen a much smaller one, which was provided with a two-horse-power steam boiler, and was declared capable of producing from 150 to 200 gallons of strong rum per diem.

I have not yet sufficiently examined the apparatus to enter on a description; but from the slight idea I caught of its mode of action, it appears, that the wash being let in at the top of a narrow wooden case, falls down through a number of sheet copper plates, which are placed at regular distances below each other, each plate being pierced with a number of small holes, which allows the wash to pass down, whilst the steam from the boiler being let in at the bottom of the case,

rushes upwards, depriving in its course the wash of its spirit, at the same time its own aqueous vapour becomes condensed and descends with the spent wash; so that by the time the steam reaches the top plate and escapement-pipe at the upper end of the case, the vapour is almost entirely spirituous, with a very slight admixture of water.

I before stated, that I am not capable of giving an *authentic* description of this steam still, the foregoing must, in consequence, be considered merely as my own idea, hastily formed of its principle; but that it is a correct one I do not pretend to affirm. There are many other varieties of stills in use in England, France, Germany and elsewhere, with which I am unacquainted; the only one I can make mention of, is the native apparatus, which for rudeness of material and simplicity is unequalled. Sometimes in establishments of respectability, iron and even copper stills are used, but an earthen pot and a bamboo pipe far more generally comprise the sum total of their distilling apparatus. Yet with these most simple machines, there is every reason to believe, that really good spirit could be obtained, provided the wash to be distilled were of a good quality and well fermented.

A distil-house should be light, dry and very warm, and as mentioned in regard to a curing house, should by no means, or on any consideration, be either *dark, damp* or *cold!!* It is strongly recommended, that this be kept strictly in view when building a still-house.

The advantage of a still-house in India is very great, more especially on a sugar estate; for independent of the molasses which would result from the curing-house, a vast quantity of good and fresh molasses could in most cases be procured in the vicinity, which by arriving in "crop time," would have the benefit of being mixed with the scummings, &c. from the boiling-house, to the great enhancement in value of the rum therefrom distilled. Whilst out of crop the distil-house could be kept at work, even until the next crop comes round. There would be no occasion to stop the distilling,

so long as a supply of molasses could be procured. It would necessarily happen, that the rum made *in crop*, (when the scummings, &c. of the boiling-house were available,) would be of a superior quality to that made out of crop from the inferior molasses bought from the natives, &c., without the advantage of any boiling-house stuff.

Yet notwithstanding, it would have the same chance of being of good quality, as the common descriptions of East India rum now made by Europeans here.

The greatest care should be taken in hanging the stills, and placing the retorts, should there be any.

They should be so hung, and the flues so arranged, that the greatest possible effect may be created, from the fire which is kept up, and the fuel consumed.

I have known a still in the West Indies, which by being badly hung, was generally 14 to 16 hours running off *two* charges; and afterwards, being re-hung by an experienced hand, constantly ran off *three* charges, in from twelve to fourteen hours; and this too of the same wash as before, no alteration being made. It will by this be seen, how requisite it is to have stills well hung, as it saves time, labour, fuel, &c. &c. to such an extraordinary degree.

The chimney of the still *never* requires to be above 50 feet in height, and very often 30 or 40 feet are considered preferable. At the entrance to the chimney a damper is very necessary, as thereby the stiller-man can in a moment check any improper degree of heat to his still, which can be readily detected by the unequal manner in which the spirit flows from the pipe; one moment running slowly, and the next being blown out, in a large stream, attended with a loud blowing noise. This proceeds from the liquor from the still, or the low-wines from retorts being forced by the excessive heat over the "*goose neck*" of the still, or helm of the retort.

This will all be treated of in detail, when we come to the system of work in the distil-house department.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. IX.—1843.—Vol. II.

Report of trials made of the power of Bramah's Hydrostatic Press, as applied to the extraction of Oil from various products. By Alexander Gibson, Esq., *M. D*

To James Hume, Esq. *Honorary Secretary, Agricultural and Horticultural Society.*

My dear Sir,—I have the pleasure to send you a copy of some experiments made on oil seeds with Bramah's press. The oil it produces is allowed by the natives to be considerably clearer and freer from vegetable admixture than that got by the plan of the pestle and mortar, as in use among the natives.

Your's sincerely,

(Signed) Alexander Gibson.

Report.

1st,—Boee Moong, or Earth Nut, Arachis Hypogea.

120 Pucka seers by measurement put in the press.

Product by 1st pressure, ..	50 lbs.
By 2d, ...	30
Total, ...	80
Remaining of oil cake, ...	154
Probable loss by absorption, wastage, bags being new, ...	6 lbs. of oil.

A calculation of expenses and return cannot be accurately made, as this oil is one never made excepting to order, and even then it cannot be made by common process without admixture of other seed.

	Rs.	As.	P.	Rs.	As.	P.
The rate of 12 annas for 10 lbs. may be deemed a low valuation, at this rate 80 lbs. are in value,..				6	0	0
Oil cake, value per rupee 125 lbs., ...				1	4	0
Total, value of oil and oil-cake, ..				7	4	0
Expenses,—viz.: cost of material, ..	5	0	0			
Labour, 4 men for $1\frac{1}{2}$ days at 2 annas each per diem, ...	0	12	0			
Sewing, twine, wear and tear of bags,..	0	8	0	6	4	0
Return nett profit, ...				1	0	0

The oil produced was judged at the Medical Stores to be of quality such as to form a perfect substitute for the Europe olive-oil now used. In which case the price realized may be safely stated at double that above estimated. Specimens were forwarded to the Medical Stores and to the Revenue Commissioner.

2nd,—Kurdee, or Carthamus Oil.

Quantity tried, 196 pucka seers by measurement.

Oil extracted, 63 lbs. by weight.

Oil cake, 328 lbs.

	Rs.	As.	P.			
Value of oil, at 12 annas for 10 lbs. ..	4	11	6			
Ditto ditto of oil cake, at 128 lbs. ..	2	9	0			
				7	4	6
Deduct.						
Value of material at 40 pucka seers per rupee, ...	4	14	3			
Labour, 4 men for $1\frac{1}{2}$ days, ...	0	12	0			
Wear and tear, sewing and twine, ..	0	8	0			
				6	2	3
Nett profit on the above, ...				1	2	3

The above experiment I do not consider to be at all conclusive in regard to the value of this product for oil, in as much as the natives state (and I believe truly) that the Kurdee, of which by the way very little is grown in the western Deckan, produced here, is very inferior in oiliness to that produced in the eastern Deckan from the Bald Carthamus.

The latter is not grown here. I have tried to introduce it, but hitherto without success. I do not recommend the Carthamus as a seed fit for the oil press. It requires to be previously rough ground, and even then the strain required for extracting the oil, is very heavy. With a machine having bearing pillars, this objection would apply in a lesser degree.

The oil produced by the machine is of quality superior to the bazar oil, and the value above affixed may be reckoned low.

3rd,—Linseed mostly three years old.

Quantity worked up, 123 pucka seers by measurement.

This quantity was slightly wasted to rid it of the mucilage, and afterwards put into 17 bags. Result of first pressure,

33 lbs. of oil; then taken out, turned, and sprinkled with hot-water;—second result 29 lbs. equal in purity to the first.

Total, ...	62 lbs.
Oil cake, ...	168 lbs.

In the above experiment, there has occurred about 10 lbs. of waste, partly, I believe, from the bags being new.

Local value, unknown, as it is never made excepting to order. In February last, I sold in Bombay a quantity made by the country mill, at rupee 1-8 per gallon of 8 lbs. or pints. Rupees 2 was the price first offered, but owing to sediment, this price was reduced to 1-8. Now as the oil from the press is quite without sediment, I believe that it would be readily purchased at Rupees 2 per gallon.

	Rs.	As.	P.			
Therefore the value of 62 lbs. sold in Bombay, may be estimated at, ..	15	8	0			
Oil cake, at 128 lbs. per Rupee, ..	1	5	0			
				16	13	0
Total value of produce, ...				16	13	0
From this deduct cost of material, at 30 pucka seers per Rupee, ...	4	1	9			
Labour, 4 men for 2 days, roasting and pressing, ...	1	0	0			
Fire-wood, ...	0	2	0			
Wear and tear of bags, &c., ...	0	8	0			
Proportion of carriage of 62 lbs. to Bombay, at 4 Rupees per 240 lbs.,	1	0	6			
				6	12	3
Estimated profit from each making,				10	0	9

Of this oil I have yet sent no specimens to Bombay, but can do so if required.

The machine works on this seed with great ease.

The proportion of oil got by the country process from linseed is rather less than the above, and a further loss is sustained by the quantity inseparable from the copious sediment.

In the two workings I had this season before the machine broke, the quantity each time was rather less than the above; being first, 20 seers pucka, equal to 40 lbs. of oil from 96 measured pucka seers of seeds; and second, 42 lbs. from a like quantity.

4th,—Cocoanut Oil.

Seventy-nine and a quarter pucka seers of the half dried material as sold in the bazar, were put into the press. Extracted with much difficulty 42 lbs. of oil, and could go on no longer on account of the impossibility of keeping the plates from slipping; strong sticks put in as supporters having been repeatedly snapped in twain. The want of two middle bearing rods of strong iron to fit into and steady the plates was here most severely felt, as indeed was the case more or less throughout. I can hardly imagine that the builders of this press (Simpson and Co. Belgrave-road, Pimlico,) could ever have made a press for oil before, else they must have seen the want of this essential particular.

The tear of bags and waste of labour caused by the constant efforts to buttress and keep straight the plates, may be fairly estimated at six annas on each pressing.

5th,—Sesamum Oil.

Two pucka maunds of seed, value five rupees and eight annas, were pressed. Failure as complete as in the cocoanut, and from exactly the same cause. Oil produced of superior quality.

6th,—Khorasanee, or Black Til.

Ninety-six pucka seers by measurement pressed.

Result.—Oil 25 pucka seers, equal to 50 lbs.

Oil cake 80 pucka seers.

	Rs.	As.	P.			
Value of oil, at 12 annas per 10 lbs.,..	3	12	0			
Oil cake, at 64 pucka seers, ...	1	4	0			
				5	0	0
Deduct.						
Value of Material, Rupees, ...	3	3	0			
Labour, ...	0	12	0			
Wear and tear, ...	0	8	0			
				4	7	0
Nett return, ...				0	9	0

7th,—Castor Oil.

Result of two pressings, each of $2\frac{1}{2}$ Indian maunds of the seed, gave as nearly as possible the proportion of 2 lbs. of oil, to 8 lbs. of seed. Oil pure and of first rate quality, but required straining to separate the mucilage.

The rate at which this oil is supplied to the Medical Stores by the Commissariat, is, as per return, 7 Rs. 8 Annas per maund of 28 lbs. I will then affix to mine a medium value, say 5 Rs. for 28 lbs. The return will then stand as follows :—

	Rs.	As.	P.			
Price of 80 lbs. of seed, ..	2	0	0			
Expence of pressing do. ½ day, 4 men,	0	4	0			
Bags, wear and tear, ...	0	6	0			
				2	10	0
Cost.						
Produce, 24 lbs. oil, ...	4	4	3			
Oil cake 56 lbs. valued as a manure for vines, &c., ...	0	4	0			
				4	8	3
Nett return from each maund, ..				1	13	3

or take 2½ maunds, (pucka measure,) the quantity which can be pressed at one time. Return 60 lbs.

	Rs.	As.	P.			
Value of 60 lbs. oil, at 5 Rupees per maund, ...	10	12	0			
Oil cake from ditto, ...	0	10	0			
				11	6	0
Deduct.						
Labour, 4 men 6½ days, ...	0	12	0			
Value of material, ...	5	0	0			
Wear and tear of bags, ...	0	8	0			
				6	4	0
Nett return, ...				5	2	0

The difference in the above estimates is owing to wear and tear having been estimated too high in the first. From the above it will be seen, that the probable profit on castor oil is next to that on linseed, and as the extraction of castor oil is comparatively easy, the extended working of the machine on both of these products is to be recommended. New seed would have afforded more oil. I made repeated trials on the various material for bags to contain the oil seed; on the whole I find that the common bazar blanket is the best, and cheapest of all. The strong cloth used by Wunjaras for grain bags is expensive and stiff, and owing to its great stiffness, brittle.

Errors Excepted,

(Signed) ALEXANDER GIBSON,

Superintendent, Botanic Garden.

Government Garden, Hewra, 27th June, 1843.

Particulars regarding the Salep Plant, procured at Kotrah and other places in the neighbourhood of Neemuch. By Lieut. J. C. Brooke, 63*rd N. I., Adjutant Meywar Bheel Corps.*

My dear Sir,—Accept my best thanks for your communication, and for your trouble in sending the recipe for the preparation of salep misree, and for proposing me as a member of the Articultural Society. The salep misree found by me, is I believe, the real "Orchis Mascula." I did not bring any in with me, for the part of the country where it grows is some distance off, as you will perceive by the little rough sketch opposite, which I have made to shew you the position in which it grows. The road from Kotrah to Kherwara is 80 miles long from its windings, as the crow flies 60 miles. There is no good map of this country, excepting Ballin's lithographic map of it, which perhaps you may not have. The common ones are grossly false, as they make the Saburmuttee to rise in the Deybur Lake, whereas the Deybur is only 1000 feet above the sea, and the Saburmuttee rises near Gogoondah at the height of nearly 4000 feet above the sea. Gogoondah has greater advantages than any other place in India perhaps for a sanatarium, being in a fine open plain approachable for laden cattle, and might be easily made so for carts; good water everywhere from wells, air dry and bracing, and no clouds to cause rheumatic affections. I have already recommended it as a sanatarium. From Gogoondah, the land gradually falls, and the hills rise in height as they recede, their valleys being deeply cut by the numerous rivers. The range (in the map) is the only one I have entered (=) though all the other spaces are filled with high hills, running down from their common centre, Gogoondah. The range down, is however, the highest. In the neighbourhood of each of the springs, the salep misree abounds. It was dug up in great quantities at the southernmost during the hot weather, whilst I was on duty at Kotrah. The beginning of July I

was at Gogoondah, and seeing about 6 miles from it, whilst out shooting, the white and red oleanders growing in great luxuriance up a valley, and a fine spring gushing out, (this was before any rain had fallen,) I pursued the valley further, and came upon a pretty yellow flower (Orchis,) with black spots, the leaf indented or fluted, for I am no botanist, and know not the technical terms. Rambling again over the hills, a Bheel shewed me another spring in a deep, close, jungly, shady and rocky glen. Above it, and not far from it, were more of the Orchis, some of which I dug up and sent to Aboo, where they are now growing. The soil was what had caught by the projections of the rocks, and was the richest kind of loam formed of the debris of rotten trees and vegetation. At Kotrah, the Orchis was found in exactly the same kind of place, but at not so great a height. (on a low hill,) I should not suppose more than 800 feet above the sea, which proves height is not required; besides, it is found in the rich alluvium on the banks of the Penakul and Papree rivers, which has been washed from the higher lands, covered with dense jungle, and not more than 5 or 6 feet above the beds of those rivers. When in flower, at Gogoondah, the grass had not begun to sprout, excepting at one place (Jharowlee,) a mass of springs, and where it is green all the year round. I have some by me dried in the sun and scraped with a knife, which afterwards I will send you.* It cost me 14 annas a maund; in taste and odour, it is the same as the real salep misree which I bought at Agra. It has been crushed and is a little darker in colour; but if the former be cut, there is scarcely any difference in appearance. I did not bring any of the plants with me to this, as it would have been useless, seeing I shall most probably be out at Kotrah in the cold weather, where I can procure as many as I want. In the mean time, I shall send

* Two specimens scraped and one unscraped salep misree from Kotrah, collected in May and dried in the sun.

out to have some dug up, that I may send you some, together with a portion of the soil in which they grow; but I cannot promise any thing till I go out there myself, when I will at any rate send them. I first became acquainted with their existence through a subadar of the corps, who learnt it from the Bheels, who call it "*kookur kānda*;" and heard that the Maha Rana of Oodepoor frequently sends to his petty chiefs of Jorrah and Pamerorah, requesting them to send him a supply. Subsequently, I found in Ird's work, that he had heard from the people about him, that salep misree did exist in certain localities amongst these hills. There are a variety of other native condiments grow here likewise, as highly prized, or nearly so, as the salep misree. One of them is the dhowla mislee or misree, (the white mislee.) I do not know what it is, but it is most probably an Orchis also. When in that part of the country, I will make enquiries. I forgot to mention that the above range is composed almost entirely of coarse granite and other primary rocks, with trap, gneiss and mica slate in the plains below and towards their bases, nearly vertical in their layers. I have been rather prolix, and must beg you to excuse the haste with which this is written.

Yours very faithfully,
JOHN C. BROOKE.

[The specimens alluded to in Lieut. Brooke's communication are considered to be of the best description of salep, such as is sold for sixteen rupees a seer in the bazars of this city. For some further interesting particulars regarding this very nutritious root, the reader is referred to an extract from Royle's "Illustrations of the Botany of the Himalayan Mountains," among the *selections* in the present number of the Journal.]

The Sugar Planter's Companion.

By L. Wray.

[Continued from page 218.]

CHAPTER III.

On the manufacture of Sugar, embracing the use of alkalies, evaporation, concentration, granulation, &c. &c. &c.

This operation may be said to commence in the mill-house, inasmuch as a great deal depends on the *state* of the expressed cane juice at the period of its arrival in the boiling-house. The chief responsibility of this rests on the superintendent of the mill yard, who, as I before mentioned, is designated *boatswain* of the mill-yard. The duties of this functionary consist in superintending and urging on the work appertaining to the mill-house and yard, which in its way is important, varied, and unceasing. First, he takes note of all the carts supplying canes to the mill-house; now quarrelling with the drivers for their slowness, and short loads, then encouraging and praising them, as their activity and good conduct merit his approbation. The canes brought in are subject to his searching glance; those much injured by rats, insects, &c. are quickly discerned and cast aside, as being liable to taint with acid the whole of the juice, whilst the perfect canes are whisked off to the feeding-board of the mill, as fast as the *carriers* can take them. Should they idle on this work, and the feeding-board in consequence be out of canes, one of the feeders immediately beats a loud tattoo on the board with any stray cane he can find, which noise reaching the ear of the *boatswain*, quickly brings him to the spot, charged to the brim and overflowing with wrath, which he vents on the delinquent cane-carriers, in a perfect flow of angry eloquence. Feeding the mill must also engage his attention, to see that the canes are laid fair and evenly along

the whole length of the rollers, and yet in sufficient abundance, without choking and straining the mill; as is the case, when the mill is fed carelessly and unevenly, and the canes suffered to overlap each other too much. Greasing the cogs and oiling the mill in its different parts, seeing the mill-bed kept clean and free from trash, the transport of the green-cane-trash with its drying, stacking, housing, &c.

The responsibility of the mill mules, horses, and bullocks, receiving good treatment, and protection from overwork and undue severity, such as goading, flogging, &c. by the boys appointed to drive them.* The constant cleansing and purification of the mill-bed, gutters, strainers, &c. &c. by washing down, and afterwards carefully applying lime water in every part liable to generate acidity by cane juice lodging in the different little crevices and turning sour.†

These and a variety of other little matters belong to the *duty of a boatswain*, and must engage his constant and *unfailing attention*; by which it will be seen, that it is a situation of no small importance and responsibility, and requires an active, intelligent, and faithful man to fill it satisfactorily.

The juice being expressed from the canes falls into the mill-bed, and from thence runs through a strainer, or perhaps two, into the boiling-house. To attend at this place, a boy is always stationed to keep the mill-bed clean, and free the strainers from dirt and bits of cane trash, which would otherwise obstruct the passage of the juice, and thereby cause it to flow *over*, instead of *through* the strainers. Some

* This is best obviated by giving each boy a certain spell of cattle, for the good treatment of which he is always responsible throughout the crop.

† The mill-bed, rollers and gutters should be particularly limed over whenever stopt; for if the glutinous parts of the liquor lodge within the joints and crevices, they speedily acquire a degree of putrescence which cannot fail of infecting the whole body of liquor, and destroy to a certainty all the pure juices that approach it.—*Fitzmaurice.*

planters have besides the strainer, a piece of *woollen cloth*, once or twice doubled, through which the juice is made to flow. This I am inclined to consider a good and judicious plan, as entailing little or no additional labour; whilst it certainly is beneficial to the juice, to deprive it of all extraneous matter as speedily as possible. I would even go further, and try the effect of some half dozen woollen and other strainers before it leaves the mill-house, in order that the juice might reach the boiling-house in as pure a state as could possibly be attained. The cleaner the juice, the greater length of time will it keep in the cold receivers, uninjured by fermentation.

I have now beside me a little pamphlet written about 50 years since by a West India Planter, named Fitzmaurice, which for genuine simplicity and correctness, surpasses any work on the subject that I have ever read. My poor opinion of its merits is the only tribute in my power to bestow, yet can I not withhold it, pleased as I have been by its perusal, and intending as I do, to avail myself of extracted portions of its contents.

In commencing the subject of "Clarification," he, (Fitzmaurice,) says, "The cane liquor must be clarified within twenty minutes after its expression; unless that be done, fermentation commences, to the injury of the sugar, in quality and quantity; hence the necessity of expedition in the operations of both the mills and coppers, so as to boil the juice in a pure and unaltered state, and to prevent their acquiring acidity in the process of clarification and boiling; this process requires the most superior nicety of any in the whole manufacture, as on it depends the superior or inferior quality of the sugar."

In stating that fermentation will often commence within twenty minutes after expression, Fitzmaurice evidently means a kind of incipient *vinous* fermentation, which if the rollers, mill-bed, gutters, strainers, &c. &c. through which the juice

passes be kept in an uncleanly state, will be so much accelerated, that an acetous fermentation must speedily follow.

Foul juice becomes liable to fermentation much quicker than when pure and clean; and indeed nothing can be more common than the juice of one cane piece being glutinous, thick and foul, whilst that of its immediate neighbour, is fair, clear, and rich.

Many have been the contrivances and experiments entered into, for the purpose of obviating this distressing tendency to rapid decomposition. Some put lime, potash, alum, and a variety of other substances into the fresh expressed juice to preserve it.

Dr. Leibig informs us, that all those substances which appear to possess the property of entering spontaneously into fermentation and putrefaction, do not in reality suffer those changes without some previous disturbance in the attraction of their elements. Eremacausis always precedes fermentation and putrefaction, and it is not until after the absorption of a certain quantity of *oxygen*, that the signs of a transformation in the interior of the substances shew themselves.

It is a very general error to suppose, that organic substances have the power of undergoing change spontaneously, *without the aid of an external cause.* When they are not in a state of change, it is necessary, before they can assume that state, that the existing equilibrium of their elements should be disturbed; and the most common cause of this disturbance is undoubtedly the *atmosphere,* which surrounds all bodies.

The juices of the fruit or other part of a plant which very readily undergo decomposition, retain their properties unchanged as long as they are protected from immediate contact with the air; that is, as long as the cells or organs in which they are contained resist the influence of the air. It is not until after the juices have been exposed to the air, and have absorbed a certain quantity of oxygen, that the substances dissolved in them begin to be decomposed.

The beautiful experiments of Gay-Lussac upon the fermentation of the juice of the grape, as well as the important practical improvements to which they have led, are the best proofs of the atmosphere having an influence upon the changes of organic substances. The juice of grapes which were expressed under a receiver filled with mercury, so that air was completely excluded, did not ferment. But when the smallest portion of air was introduced, a certain quantity of oxygen became absorbed, and fermentation immediately began. When the juice was expressed from the grapes in contact with the air, under the conditions therefore necessary to cause its fermentation, still this change did not ensue, when the juice was heated in close vessels to the temperature of boiling water. When thus treated, it could be preserved for years, without losing its property of fermenting. A fresh exposure to the air at any period, caused it to ferment.

To take advantage of this fact, by availing himself of the benefits to be gained, the planter would only have to substitute thin sheet iron receivers, for the cold receivers before spoken of. These former would be furnished with an air-tight cover, and be hung over a small furnace, so that once brought to the boiling point, the fire could be removed, and the liquor kept perfectly sweet and unchanged for days, weeks, or even years.

Dr. Ure, however, gives us a far more simple method of attaining the same end, as above proposed. He writes, "It does not appear that our sugar colonists have availed themselves of the proper chemical method of counteracting that incipient fermentation of the cane-juice, which sometimes supervenes and proves so injurious to their products. It is known, that grape-must, feebly impregnated with sulphurous acid, by running it slowly into a cask in which a few sulphur matches have been burned, will keep without alteration for a year; and if "*must*" so *muted*, is boiled

into a syrup within a week or ten days, it retains no sulphurous odour. A very slight muting would suffice for the most fermentable cane-juice : and it could be easily given, by burning a sulphur match within the cistern, immediately before charging it from the mill. The cane-juice should in this case be heated in the clarifier, so as to expel the sulphurous acid, before adding the temper lime; for otherwise, a little calcareous sulphite might be introduced into the sugar. Thus the arescence so prejudicial to the saccharine granulation, would be certainly prevented."

Such an apparently insignificant mean of accomplishing this desirable end, only serves to shew us, how powerful an ally we can form to ourselves by embracing the friendly aid of chemistry ; and whilst the methods used may truly be characterised as being the very quintescence of simplicity, the effect of their action is of so astonishing a nature, as to stagger our belief, and for a time render us incredulous.

I have not myself tried this mode of arresting and preventing fermentation in expressed cane-juice, but I can have no possible reason for doubting the accuracy of the statement, resting as it does on the authority of Dr. Ure, a man celebrated throughout the known world for his deep researches in the chemical branch of science, as also for polite and scientific knowledge generally.

I will not dwell on the many advantages of being able to keep juice, from the mill, any length of time, until it would be convenient for the planter to have it clarified, as these advantages are pretty commonly known; but merely advert to an "*object*" to be gained, which in every way bears strict connection with the point at issue. This is to discover the several bodies existing in the juice of various descriptions of Cane, and to render available, the *whole* of the crystallizable portion.

Few subjects have so entirely puzzled the various writers on Sugar manufacture as the bodies combined in cane-juice; and the different experiments with their results, made by

eminent chemists and others, together with the strange descriptive names each operator affixes to the substances discovered therein, have left us, with anything but clear and satisfactory notions on the subject. It is with the utmost diffidence, therefore, that I venture to advance any opinion of my own in explanation; more especially as I am not certain whether *my* efforts may not serve to render "confusion, worse confused."

In the Preface to Liebig's celebrated work on Organic Chemistry, &c. &c., he thus expresses himself: "Innumerable are the aids afforded to the means of life, to manufactures and to commerce, by the truths which assiduous and active enquirers have discovered and rendered capable of practical application. But it is not the mere practical utility of these truths which is of importance. Their influence upon mental culture is more beneficial; and the new views acquired by the knowledge of them, enable the mind to recognise, in the phenomena of nature, proofs of an infinite wisdom, for the unfathomable profoundity of which, language has no expression."

It is the encouragement afforded by such facts, so forcibly expressed, that imparts confidence to such humble enquirers as myself, and induces them to submit, to the superior intelligence of the scientific body, their own rude notions. A generous consideration is always to be hoped for, and if "*in error's devious paths we stray*," even correction can be rendered doubly pleasing, if administered in a spirit of good fellowship and gentle courtesy; trusting therefore to receive the full benefit of this polite forbearance, I hesitate not to hazard the remarks which will follow, for the consideration of my brother planters, and readers in general.

According to *Dutrone*, one of the oldest and most correct writers on this subject, Sugar Cane-juice consists (in its unaltered and most perfect state,) of Sugar, extractive, and two different kinds of fecula, (which can be precipitated by the use of a judicious proportion of lime,) but no kind of acid.

Dr. Higgins in his "Observations, Phil. Mag." lays great stress on two bodies, which he reports as being contained

in Cane-juice, analysed by him in the West Indies, and which he calls, "*herbaceous matter,*" and "*molasses acid.*" Proust, when residing in Spain, in the midst of Cane culture, (though on a small scale,) made many experiments on the expressed juice of the Cane, and says, he found it to contain gluten or green fecula, gum, extractive, malic acid, sulphate of lime, and two distinct species of Sugar; viz. a kind of syrup incapable of crystallization, and common Sugar, which differs from the foregoing in being crystallizable. The malic acid was extremely minute, and may be considered as foreign to the real nature of the plant, when in a perfectly congenial soil and climate, and brought to a right state of maturity.

Cane-juice in its most perfect state, has repeatedly been found entirely free from any acid; but it is very reasonable to imagine, that many undesirable substances may be found to exist in the juice of Canes grown in an uncongenial climate and soil, and which have been most probably subjected to an erroneous mode of cultivation, which latter would alone be sufficient to account for their presence. The juice of Canes, grown by natives in this country, for instance, shew that although possessing the advantage of a congenial soil and climate, yet by the improper manner in which they plant, and treat the Canes in their progress toward maturity, they can only obtain a juice, containing many undesirable bodies, and consequently of inferior value for Sugar manufacture.

I am inclined to pronounce Otaheite and Bourbon Cane-juice, (in its most perfect condition,) to contain sugar, water, and two kinds of fecula, *one* of which I consider identical with the "green fecula" of Proust, and the "herbaceous matter" of Dr. Higgins, and may without difficulty be separated by a judicious application of lime, usually termed "temper lime;" whilst the *other* is of a more gummy and obstinate nature, entering so intimately into combination with the crystallizable matter, as in a measure to set at defiance all attempts hitherto made to separate or precipitate it. This is what produces molasses.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. X.—1843.—Vol. II.

CORRESPONDENCE REGARDING THE UNSUCCESSFUL CULTIVATION OF AMERICAN COTTON, AT THE GOVERNMENT COTTON FARM AT GORRUCKPORE.

(Presented by the Government of India.)

To James Hume, Esq., *Secretary to the Agricultural and Horticultural Society.*

Home Department, Revenue.

Sir,—I have the honor to annex copy of a letter from the Secretary to Government, North Western Provinces, No. 5192, dated the 18th ultimo, and of its enclosures, and to request that you will be good enough to forward to this Office, for transmission to the Government Cotton Farm at Gorruckpore, a few pounds of Bourbon and Egyptian cotton seeds, in sufficient time to reach that station in January next.

I am, &c.

(Signed) T. R. Davidson,

Offg. Secy. to the Govt. of India.

Council Chamber, the 2nd December, 1843.

To T. R. Davidson, Esq. *Officiating Secretary to Government of India, Fort William.*

Revenue Department.

Sir,—I am directed by the Hon'ble the Lieutenant Governor to transmit, for the purpose of being laid before the Right Hon'ble the Governor General in Council, the accompanying copy of a Correspondence with the Officiating Commissioner of the Benares Division, regarding the American cotton cultivation in Gorruckpore.

2. Should his Lordship be pleased to authorize the experimental cultivation of the Bourbon and Egyptian cotton at the Gorruckpore farm, his Honor requests, that a few pounds of the seed may be obtained from the Calcutta Agricultural Society, and forwarded to Gorruckpore, so as to reach that station in time to be sown in January next.

I have, &c.

(Signed) R. N. C. Hamilton,
Secy. to Govt. N. W. P.

Agra, the 18*th November*, 1843.

To R. N. C. Hamilton, Esq. *Secretary to Govt. N. W. P. Financial Dept. Agra.*

Sir,—I have the honor to forward in original, a letter from the Collector of Gorruckpore, dated 16th instant, No. 477, together with its enclosures as per Margin, from Mr. Blount, on the subject of the Government cotton farm at Gorruckpore, and beg that the cotton seed required may be furnished as soon as practicable.

Mr. Blount's report dated 30th September 1843, on the state of the Govt. cotton plantation with a field Map. Ditto's application for Bourbon and Egyptian cotton seed dated 16th October 1843.
Ditto's accounts for the Month of September; viz. 6 statements. To be returned.

I have, &c.

(Signed) D. B. Morrieson,
Officiating Commissioner.

Commissioner's Office, 5th Division, Benares, the 21*st October*, 1843.

To D. B. Morrieson, Esq. *Officiating Commissioner, 5th Division, Benares.*

Sir,—I beg leave to submit Mr. Blount's report, of date 30th ultimo, with his accounts subsequently rendered, for transmission to the Financial Department.

2. Mr. Blount's accounts of the American cotton is sufficiently disheartening. Until the 15th September, nothing could have promised better, the number and size and weight of the bolls was surprising. In one week they seem nearly all to have been affected with premature decay, and the spaces between the ridges are strewed with these bolls to such an extent, as to make the lugubrious tone of Mr. Blount's letter no matter of surprise.

3. Had this result succeeded, instead of preceded the remarkable gale we have experienced on the 12th, 13th and 14th instant, it would probably have been assigned to its influence. Probably Mr. Blount is right in his opinion, that the American cotton plant is not suited to India. In Georgia it is sown in April, and the frost terminates its career in October. Here it has been sown in June, and its premature decay has been exhibited in September. I observe, however, that the top shoots have revived since the gale. Frost is unknown here until January, and the next three months will afford conclusive evidence of the correctness or otherwise of Mr. Blount's conclusions.

4. This has been, it must be borne in mind, the most extraordinary season of drought at Gorruckpore. Our rainy season ordinarily commences in the latter part of May, to terminate about the middle of October; not a third of the usual supply of rain has fallen this year. Our rains have been a moderate fall only once or twice a month, and occasional showers not sufficient to lay the dust, and no rain fell at all until the end of June.

5. A further report will be submitted respecting the American cotton, and it is now only needful to make brief notice respecting the others.

6. Banda and Jubbulpore. Some of it depressed by the late gale, generally luxuriant, but shedding abundantly without any apparent cause. Gorruckpore cotton looking well, but not expected to ripen for some time to come.

7. By a separate letter of this day's date, No. 24, Mr. Blount desires permission to try experiments with the Bourbon and Egyptian cotton. I am apprehensive that the former courts a volcanic soil, in preference to alluvial. The latter I should think suited to both our soil and climate. Should the experiment be sanctioned, I would beg leave to suggest that arrangements be made for the seed reaching Gorruckpore by the end of December next.

I have, &c.
(Signed) E. A. Reade,
Collector.

Gorruckpore Collectorship, the 16*th October,* 1843.

To E. A. Reade Esq., *Collector of Gorruckpore.*

Sir,—I have the honor to report to you the prospect of the Government experimental cotton plantations in my charge at this station, and also to enclose a field map of the farm, shewing the quantity of each kind of cotton planted in English acres.

1. I regret having to report, that the American cotton plant is an entire failure at this farm; to what causes the failure is to be attributed, I do not believe that I am able correctly to point out; the only conclusion I can arrive at (judging by the many experiments which have been tried in various parts of India, none of which have met with any thing more than partial success,) that the plant is entirely unsuited to the climate of this country; this is the third year's produce from the original seed, and if the plant will become acclimated, it should certainly in three years shew some disposition to assimilate itself to the climate; so far from this being the case, each successive crop has only shewn an unchecked and greater deteriora-

tion both in quantity and quality of produce. In Bundlecund, we supposed the failure owing to the extreme heat of the sun, with hot wind and scarcity of rains; but in this district, the plants have suffered from none of these incidents, and still the result is the same, or I may say worse, than the result of the cultivation on the Bundlecund farm last year. True, the land of the farm here is a poor sandy soil, but this poorness of soil is not the cause of failure, (had the plants produced well, it would have been only a smaller turn-out than better land would give.) I think the failure owing to that peculiarity either of soil or climate of this country, (or both,) which acts upon the American cotton plant as though it were growing in a hot wind, and forces the plants to maturity at too early an age. At this time, (only three months since planted,) when the plants should be in full vigor, they appear entirely exhausted, all the first foliage has died and dropped off; the plants are now putting out a few sickly shoots from the top bud, which may produce cotton, but such a result is scarcely to be hoped for.

2. The cotton on the best soil of this farm has grown to quite a bush, and flowered and produced young fruit plentifully, which was immediately attacked by a small worm or caterpillar which eat into both flowers and fruit, causing a great deal of damage, for every pod touched by them immediately falls off. The plants were green and flourishing up to the 15th instant, at which time the fruit commenced falling (without being touched by the worm,) and in ten days it shed off to such an extent, that I am certain there are not pods enough left on the plants to produce ten pounds of *kupas* per acre.

3. The native cotton plants (seed from Bundelcund and Jubbulpore,) are in a thriving state; the plants are from three to five feet in height, quite full of flowers and young fruit. I do not think, however, they will produce so well as cotton plants of the same size did at the farm in Bundlecund last season, and besides, I see they are shedding their fruit much

more than I have ever noticed in native cotton heretofore; however, there is every prospect of its making a good crop of cotton.

4. The Nurma cotton of this district, which I had planted, is yet quite small, but growing finely; it has not yet commenced blossoming; I think it will give its fruit late, probably not before February 1844.

I have, &c.
(Signed) J. W. BLOUNT,
Government Cotton Planter.

Office of the Govt. Cotton Plantation, Gorruckpore, the 30th Sept. 1843.

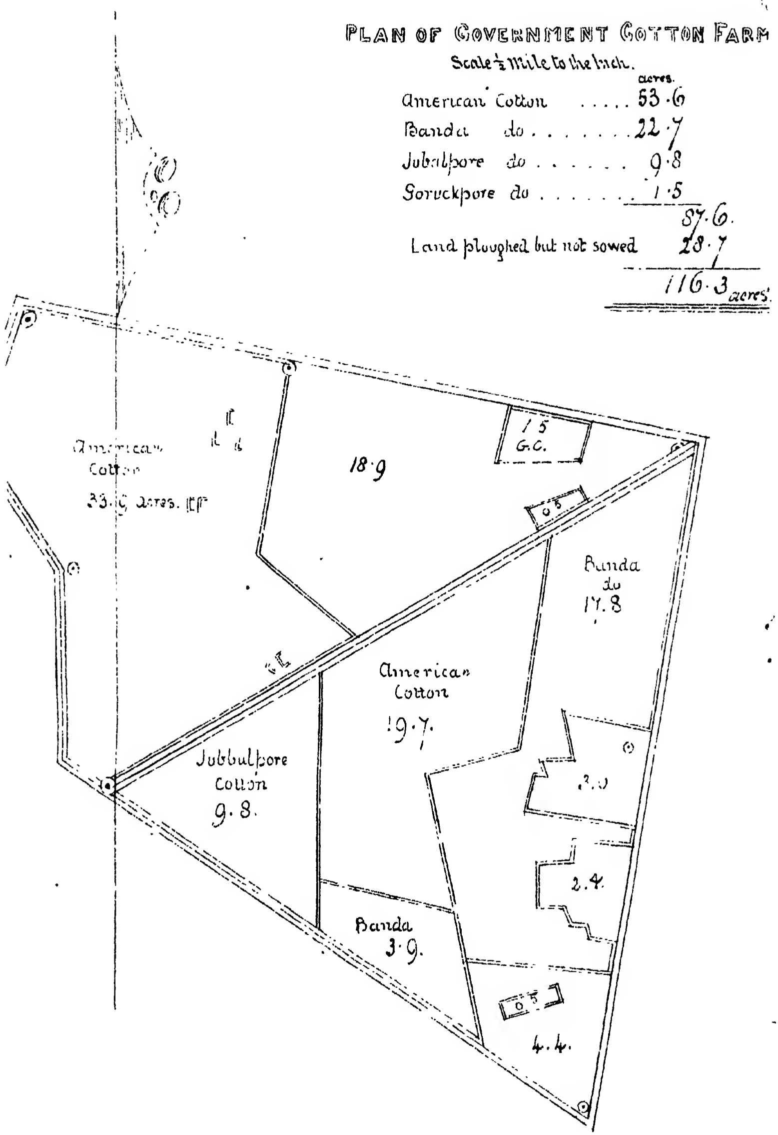
Diary of weather at Gorruckpore, for the months of August and September, 1843.

August	4th,..	Shower.	Sept.	7th,..	Heavy Rain.
,,	5th,..	ditto.	,,	8th,..	Shower.
,,	6th,..	ditto.	,,	9th, .	Heavy Rain.
,,	7th,..	ditto.	,,	13th,..	Shower.
,,	15th,..	ditto.	,,	14th,..	ditto.
,,	16th,..	ditto.	,,	15th,..	ditto.
,,	18th,..	ditto.			
,,	28th,..	ditto.			

(Signed) J. W. BLOUNT,
Government Cotton Planter.

To E. A. READE, ESQ., *Collector of Gorruckpore.*

SIR,—I wish to try on the Government experimental cotton farm at this station, the cultivation of the Bourbon and Egyptian cotton. Will you be so kind as to communicate with Government regarding the trial of these cottons, and if approved, I request that I may be supplied with a few seers of each of the above-mentioned cotton seed. I should like to have the seed by January next, as I intend planting them during


PLAN OF GOVERNMENT COTTON FARM
Scale ½ Mile to the Inch.
acres.
American Cotton ..... 53·6
Banda do .... 22·7
Jubalpore do ...... 9·8
Goruckpore do .... 1·5
87·6.
Land ploughed but not sowed 28·7
116·3 acres.
American Cotton
33·6 acres.
18·9
1·5 G.C.
0·5
Banda do 17·8
American Cotton
19·7
Jubbulpore Cotton
9·8.
2·4
Banda
3·9.
0·5
4·4.

that month, and grow the plants by irrigation until the rains set in. I suppose the seed may be procured from the Calcutta Agricultural Society without difficulty.

I have, &c.

(Signed) J. W. BLOUNT,
Government Cotton Planter.

Office of Government Cotton Plantation,
Gorruckpore, the 16th October, 1843.

To D. B. MORRIESON, ESQ., *Officiating Commissioner, Benares Division.*
Revenue Department.

SIR,—I am directed by the Hon'ble the Lieutenant Governor to acknowledge the receipt of your letter, No. 12, dated the 21st ultimo, with its enclosures, respecting the American cotton cultivation at Gorruckpore.

2. His Honor regrets to learn the unfavourable accounts given of the farm at Gorruckpore; but will anxiously await the further report promised in para. 5 of Mr. Collector Reade's letter to your address of the 16th ultimo.

3. A copy of the letter of this day addressed to the Government of India, regarding Mr. Blount's proposition to try an experimental cultivation of the Bourbon and Egyptian cotton is annexed for your information. I have, &c.

(Signed) R. N. C. HAMILTON,
Secretary to Government N. W. P.

Agra, the 18th November, 1843.

Observations regarding the Culture of foreign varieties of Cotton at Sydney. By J. V. THOMPSON, ESQ. M. D. F. L. S. *Deputy Inspector General of Hospitals, at Sydney.*

(Presented by the Government of India.)

To JAMES HUME, ESQ., *Secretary to the Agricultural and Horticultural Society.*
Home Department.

SIR,—I am directed to transmit, for the information of the Agricultural and Horticultural Society, the accompanying copy of a letter from the Deputy Inspector General of Hos-

pitals at Sydney, dated the 12th August, forwarding, with observations, samples of cotton, the result of some experiments in crossing the different kinds.

I have, &c.

(Signed) T. R. Davidson,

Offg. Secretary to the Government of India.

Council Chamber, the 2d December, 1843.

The Right Hon'ble Lord Ellenborough, *Governor General of India, &c. &c. &c.*

My Lord,—I have the honor to submit herewith samples of cottons (*kupas,*) the result of some experiments in crossing the different kinds this last season, in addition to the communications which have already been transmitted to your Lordship's predecessor, and laid by His Lordship before the Agricultural and Horticultural Society of India.*

These experiments have been most satisfactory, and clearly point out the way in which any variety may be altered and improved, and in fact completely changed in its nature. My principal object, however, this season, has been to ascertain, if a late cotton; viz. one that expends all the first period of its growth in producing what I call multiplying branches, could be made *early,* and to shoot out its flowering branches first. This, I am happy to say, has been most satisfactorily accomplished, as exemplified in a late variety of Bourbon herewith sent and the Peruvian cotton also enclosed; the same effect has been produced on the Brazil cotton, and what is further remarkable in this kind is, that the seeds, in place of being firmly united together, are separated and dispersed in the cotton wool, which, at the same time, has been rendered much longer, finer, and more easily separable. The samples above referred to, also shew the effect produced on pure *white* cottons by crossing from coloured varieties, but this is still more

* These communications will be found in the first volume of the Journal, page 183.—Ed.

obvious in the two samples of Sea Island cotton now sent, which are selected out of a variety of five or six different tints, which were produced by crossing with Brown Maltese the preceding years, and would all meet with a ready sale in China, and prove very remunerative.

I have a number of other most interesting and improved crosses, which when multiplied, I hope to have the honor of sending to your Lordship.

And have the honor to be, &c.
(Signed) J. V. THOMPSON,
Depy. Inspector General.
(True copy,)
T. R. DAVIDSON,
Offg. Secretary to the Government of India.

Sydney, N. S. Wales, August, 12, 1843.

Replies to Queries regarding Manures, from Lucknow and Fyzabad. Communicated by CAPTAIN G. E. HOLLINGS.

["I avail myself of the present opportunity, now that I am forwarding some information regarding the cultivation of wheat in the immediate vicinity of Lucknow, to enclose the answers that I have received at Lucknow, and from Fyzabad, regarding *manures.* I regret exceedingly that a want of knowledge on Agricultural subjects generally, should prevent my sending what might be considered more technical replies, but I have asked the opinion of the humble cultivators of the soil, who are the only practical agriculturists, and forward the result of my enquiries. I beg to assure you, that as far as the collection of information goes, I shall always be really happy to render myself useful to the Society, which, I am firmly convinced, in spite of the damper that has been thrown on its exertions by the withdrawal, by the Indian Government, of the power of franking letters and parcels of seeds, will prove of infinite benefit to the country; and so long as I am associated with it, I shall consider it my duty to be one of its active members."]

Answers to the Questions regarding Manures from Lucknow.

(The list of Queries will be found at page 129 of the Journal.)

1. Sheep and goat's urine and dung are beneficial for sugar-cane and the spring crop.

3. Night soil is a better manure than the dung of animals, after it is well saturated with rain.

4. Chukouree, leaves of chhewl (name of a tree,) and roos (name of a tree,) the straw and ashes mixed with dung make a good manure, after they are kept for one year in a ditch, and well mixed with rain water.

5. Manure cannot be useful before it is kept for one year.

6. It is not known, whether lime and saltpetre are of any use for manure or not.

7. Leaving the land fallow every two years increases the strength of production in the ground, but it is necessary to plough it every year.

8. Rotation of crop is more productive than sowing the same seed every year.

9. The ashes of burnt wood, are not of much benefit.

10. Dead animals are beneficial for oranges, vines and peaches.

11. The ground bones of animals are mixed with the compost used for grafting.

12. Manure made with saltpetre, the leaves of vines, bamboos, mangoes, and straw, are beneficial for pine apples and Europe fruits.

13. Dung of domestic animals, who get gram, is preferable to that of those which do not feed on gram.

14. Lona (brackish earth,) is beneficial for tobacco, cucumber, radish, the egg plant, and toraee; saltpetre is not used.

15. Old straw mixed with manure is the best manure for bamboos and rice.

18. Rotation of crops every two years, causes a great increase in production.

19. Dung of animals (camels, sheep, horses,) night soil, old straw, the leaves of mangoes, roos, plass, bamboos, and vines. Bhoosa, decayed grass, and putrified corn stalks are used to mix with manure.

20. Steeping seeds of plants in urine before sowing, is not common in India.

23. Burnt and unburnt leaves are both useful for manure; but the latter are better than the former.

Answers to the Questions regarding Manures from Fyzabad.

1. Animal's urine generally is injurious, not beneficial for manure; but that of sheep is good for every kind of crop, especially for sugar-cane. They pen flocks of sheep for this purpose on fields at night time.

3. Night soil is a better manure than the dung of animals, but it is necessary to keep it for one year in a reservoir, and after it is well putrified and saturated with rain, it is useful for fields and garden plants; there is not any fixed quantity for each Biswah; if this manure is applied to any extent, it will cause so great a heat in the soil as to be destructive of vegetation.

4. The way of preparing manure with dung is thus;—that it should be kept in a ditch until it is well putrified and mixed with rain water, after which it is exposed on a plain for two days to remove its heat, and then thrown on fields and garden ground; such manure is never used for vines; no other things are mixed with dung, excepting straw, or leaves of trees.

5. Animal manures are not applied fresh, but in a state of putrefaction, and in winter, not in summer. Pigeon's dung is mixed with such manures, and is beneficial to fruit trees and vines.

6. Manure made of lime and saltpetre is injurious to trees, not beneficial.

7. Leaving the land fallow every two years, or seven times in twenty years, increases the strength of production in the ground.

8. Rotation of crops is more productive than sowing the same seed every year.

9. The ashes of burnt plants or wood are injurious, but ashes of burnt cow-dung, if mixed with manure, are beneficial to trees.

10. Flesh or blood, is not mixed with manure in India, but they are thrown under vines.

11. The ground bones of animals are not used as manure.

12. Saltpetre is never used as manure for any kind of trees, but for cucumbers, after the blade is up.

13. Dung of domestic animals, especially of those which get gram, is better, and preferable to that of those which do not feed on gram.

14. Salt is not of any use for manure, but brackish water is beneficial to poppy and cucumber plants.

15. Earth from tanks, and old straw, are of much benefit in promoting the growth of bamboos. Night soil is the best of all kinds of manures for Indian corn, (maize.)

16. Burnt clay is never used as manure.

17. Unknown.

18. Rotation of crops every year causes a great increase in production; and is necessary at least once in three years.

20. It is not in India as in China, but the dung of every animal except that of the elephant, is used as manure.

21. It is necessary to throw manure on fields, without which the production is very small.

22. Steeping seeds of plants in urine before sowing, is not common in India.

23. It is not customary to burn the straw of plants, and strew the ashes on the fields, but the leaves of trees, when putrified and saturated with rain water, become good manure.

Memorandum on the Vegetable and other Products of the Shan Country, with some account of its Trade. *By* A. H. Landers, K. S. F.

To James Hume, *Esq. Secretary of the Agricultural and Horticultural Society.*

Dear Sir,—I have the pleasure to send you a Memorandum on the vegetable and other products of the Shan country, with some account of its trade. This Memorandum has

been compiled from notes which I made during my travels in that country in 1842-43. If you think it of sufficient interest, I would request the favor of your submitting this paper to the members of the Agricultural Society at their next general meeting. I am, dear sir,

Yours faithfully,

A. H. Landers.

Calcutta, 4th December, 1843.

P.S.—A Map of the Shan country accompanies the Memorandum.

Memorandum.

Country.—Zemmie, the capital of the Shan country, is situated in latitude 20° North, longitude 100° East. The produce of this highly cultivated country is immense, and valuable beyond conception, and affords a fine field for British enterprise. In the first place, the road from Moulmein to Zemmie is far from being difficult; no unhealthy jungles to pass through, no unfordable rivers to cross, no difficult mountains to ascend or descend, the ascent being as easy on the one side, as the descent on the other; the path throughout broad and well traversed by elephants, bullocks, and ponies, which latter are brought to the Moulmein market annually, and again sold to private speculators for that of Calcutta; water is plentiful, and also food of every description. The inhabitants are well inclined towards the British, and look upon a white face as an animal of a superior *jhat,* which by the way, they themselves are unfettered with, being by religion Buddists. During my forty days' journey to Zimmie from Moulmein, I passed through splendid forests of teak, pine, and tetzee; but for trading purposes these would be useless, as there is no water carriage.

Metals.

Gold.—Gold may be found in small quantities.

Silver.—Silver is pretty plentiful, and could be got in abundance if the natives had purchasers; at present it finds its way

into Burmah, and has then to be smuggled from Rangoon to Calcutta. This could be avoided by establishing a house at Zemmie, and a branch at Maka-nan, twenty days north of Zemmie, for the purpose of exchanging piece-goods for the above article. Its value I cannot say, but some idea may be formed of it when I mention, that the Burmese and other petty dealers resort annually to the vicinity of Maka-nan, and exchange British piece goods for silver; they then return to Amarapoora, and sell their silver at a profit to native merchants. The article then finds its way to Rangoon, either for sale, or in exchange for goods from European and other merchants. From thence it finds its way into the smuggler's house, who charges one per cent for putting it safely on board ship, and having it conveyed to Calcutta or other ports. I believe the amount cost of freight from Moulmein to Calcutta, for treasure, is generally four per cent. I think the original cost cannot be much, when it yields a good profit to each individual, as it passes through their hands. There are many qualities of silver, however, but a little experience would soon make one an adept at finding out the first quality. The vessel in which I was a passenger from Rangoon, lately, had on board two lacs and a half of smuggled silver, besides rubies of 20,000 rupees value, and ten tons of copper. Another ship that sailed before, us, had also about thirty thousand rupees' worth.

Copper.—Copper is brought into the Shan country by the Chinese. From 400 to 800 annually resort there, for the purpose of traffic, from the different cities of Yunan, Santeefoo, Kainthung, and Bammoo. It is brought down in the shape of pots, pans and plates of very rude workmanship. The Chinese government will not allow the raw article to be exported, and purposely impose a heavy duty on the crude material, hence the reason of its being worked up in this form. I have seen the pots without bottoms, and plates an inch thick. There is no demand for copper at Zimmie, conse-

quently what is brought down by the Chinese, is sold cheap: if they found a ready market, much larger supplies of the metal would be brought, and piece-goods taken in exchange.

Spelter.—Spelter is brought in a manufactured state similar to that of copper. The specimens I brought with me to Calcutta, I shewed to a person who had been in the habit of dealing in that article for years, and he pronounced it superior to any thing he had ever met with. I bought 10 *vis** of it for a rupee, for the purpose of making bullets.

Iron and Lead.—Iron and lead are plentiful, and can be had cheap, but are not sufficiently valuable in the Calcutta market, and would not cover the expense of transport.

Tin.—Tin is pretty plentiful; the Karriens collect it, and bring it to the plains to exchange for rice, beetle-nut, salt, &c. Were these people more encouraged, they would, I am sure, bring the metals in larger quantities, and be glad to take other articles in exchange. A place called *Mulangee*, is the best spot for procuring tin. (See sketch attached to my paper on the black vegetable dye of the Shan country, in this Journal No. 8 of vol. II.; and the map annexed to this paper.)

Vegetable Products.

Indigo.—This product is only made for home use.

Black Vegetable Dye.—The black vegetable dye, so favourably noticed by the Agricultural and Horticultural Society, is found in abundance. As I have already entered into some particulars regarding this product, (see Journal of the Agricultural Society of India, No. 8 of volume II.,) it is unnecessary for me to dilate again upon it.

Green Vegetable Dye.—The green vegetable dye is of a fading colour, but no doubt if a proper mordant was used, it would be lasting.

Varieties of Dyes.—A variety of dyes can be procured, of exquisite and most delicate hues. Unfortunately, I neglected

* *A vis* is about 3¾ lbs.

to bring specimens of these, and of the green vegetable dye, when leaving the country.

Rice.—Rice is of two kinds; one similar to that of Bengal, the other a glutinous kind, called by the Shans *Khong-een,* very nutritive, but heating. The rice fields are terraced, and irrigated by aqueducts leading from the small neighbouring mountain streams into the fields. The Shans tell me they can obtain three crops in a year, if they like, from their grounds, in case of famine. I have seen two reaped. Grounds, situated near the river, are in general watered by large water wheels, some nearly thirty (30) feet in diameter; however, this depends on the height of the bank, as it is requisite for the diameter of the wheel to be twice that of the height of the bank. The wheel is generally made of bamboo with a hard piece of wood for an axle; floats are attached like those of a steam-boat, and the stream acting on the floats, sets the machine in motion; bamboo buckets are attached to the outer part of the rim, and a trough is placed at the top to receive water as it empties in its descent. Some of the rice is exported to Bankok, or sold to the villagers on the banks of the "*Maypeen.*"

Cutch.—Cutch is very plentiful, and like the lac it finds a ready market at Bankok.

Beetle Nut.—Beetle nut is also plentiful, part goes to Bankok; the Chinamen likewise take a considerable quantity back with them to their country.

Tea.—The tea plants abound on the surrounding hills, but the leaves are not manufactured into tea. The Shans, however, use it in the raw state: a specimen in this state was lately submitted by me to the Agri-Horticultural Society. (Vide Journal of the Society, No. 5, vol. II., page 266.)

Sugur Cane.—Sugar cane of red and yellow varieties is plentiful. The saccharine matter is manufactured into cakes. I have seen some of it beautifully crystallized.

Cocoanuts.—Cocoanuts can be procured in abundance. I

must allude to one small dwarf tree in particular; it varies in height from 8 feet to 10 or 12 feet, but not higher, and yields a small nut, about half the size of the common one, the milk is very sweet and of a very pleasant flavour; the inside of the nut is rather glutinous, and almost melts in the mouth. I am not aware if the Shans make rope from the fibrous portion of the nut; I never saw any during my travels. They prefer the fibre known as the "*Shan hemp*" to any other description.

Vegetables.—A great variety of almost every description of *sâgs, seem, gourds, &c.* I imagine that no *European* vegetables have been introduced into the country, at least I never met with any.

Oranges, Plums, Custard Apples, &c.—All these are plentiful, and of a superior description.

Hemp.—The hemp above alluded to, which is made from the fibres of the *Urtica tenacissima*, is of a superior description.* I have presented a specimen of this to the Agri-Horticultural Society. (See Journal of the Society No. 5, vol. II.)

Gum Kino.—Gum kino can be obtained in abundance near the Thorngween river, from the Karriens, in exchange for salt, at the rate of ten *vis* of salt for one *vis* of kino. Although the same mode of collecting the gum may be adopted elsewhere, it may not be out of place if I mention the way in which it is collected by the Karriens. A diagonal incision is made in the trunk of the tree, into which a pointed bamboo of one joint is thrust sufficiently far to support its weight; the gum flows freely during the day, but much more during the night, and the people in consequence generally make the incisions in the evening to allow of its running during the night.

(The produce of Uncaria Gambir?)

Turpentine—Is not an article of commerce; the Shans

* *Extract of a letter from a Native Merchant, residing in Calcutta.*—"I have examined your specimen of hemp. I have been long dealing in the article, but never saw any hemp of equal quality. I consider it to be a very superior description."

extract a little for their own use. There are large tracts of country covered with forests of pine, which would yield an enormous quantity of liquid.

Miscellaneous Products.

Rubies.—Rubies are to be found North West of Mukanam, and are held in high estimation amongst the Burmese and Shans, who give great prices for fine ones. A merchant residing at Zemmie would, no doubt, be able to collect a few, for the ruby venders would much rather sell them to a merchant than to the chiefs or other wealthy men, for it is very probable that these latter would keep them and not pay for them. These venders, in order to prevent such a result, dispose of their rubies, in a most guarded manner, to traders either from Bankok or China. A few of the rubies are taken into Karrinee and from thence to Moulmein.

A variety of colored and transparent stones are to be met with. I am not however acquainted with the names or value of them.

Cinnabar.—Cinnabar is brought from China, and sold in the Zemmie bazar at the rate of ten *tickals* for a Company's rupee.

Arsenic.—Red and white descriptions of arsenic are plentiful in the bazar.

Ivory and Deer's Horn.—These are plentiful. The Chinese traders convey away as much as they can obtain. The remarks in regard to rubies, are equally applicable to ivory.

Stick-Lac.—Stick-lac is plentiful at Zemmie and its vicinity. It finds a market at Bankok; numerous boats find their way every cold season from Bankok to Zemmie, and the traders give in exchange for the stick-lac and other produce, the following; viz. China crape-scarfs, China plates and cups, some British piece goods, French gun-locks, inferior China tea, &c.

Silk and Cotton.—Silk of many qualities is to be had in abundance, and also cotton.

Pearls.—An inland fishery exists on the great Cambodia river, twenty-two days' journey to the eastward of Zemmie. From native information I gleaned that the natives of the town, called Mong-la-ka-bam, search about the rocks, catch the oysters, and eat them; make spoons of the shells, but place no value on the pearl. The Shans place no value on them I know, and I myself appeared to be quite indifferent as to their value, having at that time some hopes of returning to the country. I purchased two spoons manufactured from the shells, for which I paid four annas each; I brought them to "Moulmein" with me, and made them a present to a gentleman there. A large caravan of Chinamen annually visit the above place for the purpose of trade. The produce of Mong-la-ka-bam I could not get any information about, very few of the Shans having ventured so far.

I met with a great many curious looking articles in the shape of stones, &c., during my travels over the country, and brought away specimens of each, with the view of learning if any could be turned to account. On reaching the confines of the Tenasserim provinces, I discharged my Shan coolies, under the impression that I could easily replace them. Such, unfortunately proved not to be the case. Although there were many people in the vicinity, I could not persuade them to render me assistance, notwithstanding that I offered to remunerate them for their trouble. In consequence of this unexpected circumstance, I threw not only all these specimens, but the greater part of my clothes into the Thongween river, rather than allow them to fall into the hands of the natives.

In the foregoing list, I believe, I have given the principal products of Shan and the neighbourhood. I think the best means for carrying on a mercantile house at Zemmie would be thus: I reckon that the journey from Moulmein to Zemmie would occupy thirty days, that is, by a division of ten easy stages, of three days, for each stage. This journey can be performed by elephants, and I have assumed so much as three days for each stage, with the view of saving

the animals from much labour. One elephant stationed at the end of each stage would require ten elephants for the whole journey, which, at a cost of 300 rupees for each beast, would form an outlay of 3000 rupees. These elephants might be kept continually going to and fro, taking up piece goods and returning with the most valuable of the produce. The copper, spelter, &c. could be sent down on bullocks purchased in Shan at a moderate price, and again sold at Moulmein, and I have no doubt the Commissariat there would willingly enter into a contract for the supply of cattle for draught and other purposes. The disposal of these animals at Moulmein, would preclude the necessity of sending them back, and so save expense.

Jow Anna, chief of Zemmie, would gladly give a spot of ground to erect a house upon, which could be done at a small cost, teak plank being so cheap. This chief is anxious for an European merchant to settle in his country; in fact, his son-in-law, Jow Maque, made me promise to come back. The piece goods most in request, are Turkey red twills, long cloth, coarse book muslin, a few lappets, long cloth dyed red, green velvets and other sorts of velvet, (the Chinamen frequently asked me to get these pieces of velvet,) grey shirtings, small checks, American drill, and mule twist. Opium could also be introduced into China by the Chinese annual caravans, and I have not the least doubt a great deal might be done in this alone. If we consider the great price opium must have attained, and the great risk the dealers are subjected to in conveying it from the coast to the interior; the advantage of having this new opening for its introduction through a country where the Chinese mandarins least expect it, must be very apparent. Almost every Chinaman in the caravan, (upwards of 400) smoked opium. I am certain if a mercantile house were established at *Zemmie*, many valuable articles, in the shape of produce from China and the interior, would be brought to light, that we are totally unacquainted with at present.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. XI.—1843.—Vol. II.

CORRESPONDENCE AND PAPERS CONNECTED WITH THE CULTIVATION AND PRODUCTION OF WHEAT IN INDIA.

[In giving publicity to the following papers bearing on the cultivation, &c. of Wheat in India, the Committee of Papers deem it necessary to offer a brief account of the cause for which they were obtained. At a general meeting in May 1843, it was formally proposed, that the Society should petition the Home Government for the admission of Indian Wheat into British Ports, on an equalized duty with the production of Canada. This proposition met with attention. Before entering however into the merits of a petition, it was considered desirable that steps should be takĕn to procure every possible information connected with the cultivation and production of Wheat in India, and with this view, a Committee was appointed. The Committee lost no time in issuing circulars to correspondents of the Society, embracing the following points of enquiry :—

1.—On what description of land is Wheat grown in the districts you are acquainted with ?

2.—What rent does the ryott pay per beegah, and what is the size in square yards ?

3.—What is the cost of cultivating wheat land, including seed and rent?

4.—Is such land irrigated, and if so, how often during the growth ?

5.—When is it sown and reaped, and what the extent of crop in Calcutta bazar maunds ?

6.—Are other crops sown with it, and what are they ?

7.—At what rate per Calcutta maund could good wheat from your district be landed in Calcutta ?

8.—How many descriptions of Wheat are grown in the districts with which you are acquainted, and what are their respective qualities ?

9.—Can you favor the Society with small samples of each description procurable ?

Owing to various circumstances, which it is unnecessary to recapitulate, this call was not responded to by all, but that the request was not made in vain will be evident from a perusal

of the communications now published. Several months necessarily elapsed before all the returns were sent in, when a tabular statement and a report based thereon were drawn up. These papers were submitted at a special meeting held on the 9th March 1844, and a Petition to both Houses of Parliament was directed to be prepared. At the following general meeting on the 13th idem, the Petition was agreed to and ordered to be transmitted to its destination. Although these documents have already been given to the public, through the medium of newspapers, as a part of the "proceedings" of the Society, the Committee of Papers deem it advisable to republish them in the Journal, with the view of inserting in one place all the papers connected with this useful enquiry.]

Replies from Colgong. *By* John Oman, Esq.

In compliance with your request, I have the pleasure of replying to the several queries contained in your letter of the 15th instant.

1st. Wheat is grown on alluvial and red-clay soils.

2d. The ryott pays from four annas to two rupees per biggah, containing 55 by 55, and 60 by 60 yards.

3d. The cost of cultivating seed and rent averages from 3-8 to 5-8.

4th. Wheat lands are not irrigated.

5th. Wheat-sowings commence in October, and the crop is gathered in April. The extent of the crop I cannot at present ascertain.

6th. No other crops are sown with wheat.

7th. Good wheat can be landed in Calcutta at one rupee per maund.

8th. I am not aware of more than four descriptions of wheat, and these are called by the natives Doodie, Soonticrie, Jamali and Buvgamoo.

I have this day despatched by dak bangy, four samples, and will, at a future period, state their several qualities.

Colgong, 20th June, 1843.

Replies from Monghyr. *By* Peter Palmer, Esq.

Observing in the papers the other day, some questions published, to which the Agricultural and Hoticultural Society are seeking replies, on the great subject of wheat and

its transportation to England, I have been induced to give you as much information on this head as I have been able to glean, for the last seven or eight years, as a farmer in this district. I have been as concise as I possibly could, though the matter can be easily extended; however, at any other period you can command my knowledge.

1st. Wheat in this district is grown on various kinds of land: *Bheetah, Chour* and *Deerah.* In the two first, the production is generally of the first quality, fine, white and plumpy, called *doodeah,* but the quantity less, from three to six maunds. In the latter, though the quality is good, and the produce from four to twelve maunds per beegah, yet the color is dark, and it is called *Jum-mawley.* A third, and of inferior quality, can be had, this is of a very small grain, dark, and like the *Jum-mawley,* and I am led to believe it is grown on lands thinly crustated with earth, with a heavy bed of sand beneath, which gives but little nourishment to the roots, and checks the growth of the grain. It is a very remarkable fact, if the finest *doodeah* seed be sown on a *Deerah,* the production turns out *Jum-mawley.*

2nd. In good *Bheetah* and *Chour* lands, as far as three rupees per beegah is paid by the cultivator. A small tract of land in this district only, high *Deerah,* the last spot subject to inundation, pays four rupees the beegah; this spot occupies the *Rubbee* (summer,) *Bhudwee* (rainy,) and sometimes the *Khureefee* (winter) crops in one season, and from its rich and generative properties, no doubt is taxed at so high a rate by the Zumeendar. The *Deerah* lands are taken at from twelve annas to two rupees and eight annas per beegah. The beegah is 3,025 square yards.

3rd. The cost varies according to season. The chief expenses lay, *first* in the price of the seed, which is purchased by the ryott at from thirty to forty seers the rupee, oftener the first; and sometimes it is sold to the ryott by the Maha-

juns, or monopolizers of the grain, at the prevailing bazaar rates, without money payment. In this case, an agreement is then entered into, in the shape of a *tamasook* (promissory note or bond,) for double the amount to be returned *in grain*, taking good precaution of adding the "*interest-grain*" into the document first, and thereby virtuizing the face of the instrument as a non-usurious transaction. *Second,* cost of land, as stated in paragraph above, to which is to be added certain extra charges *extorted* from the already beggared ryott by the Zumeendar, under the names of *Naig;* from two pice to one and half anna is charged on every rupee he has to pay per pottah. *Butta* at the same rate. *Chowkedary, Dak-barie, Punchite, Moonshufee,* or expenses for measuring the lands; *Burgundee* for proving the good qualities of the *sicca,* or in other words extracting from the ryotts the pay of the *Purkeeah* of the village. On this subject alone, I could fill several sheets, regarding the rogueries practised by the Zumeendars and the Bankers of the zillahs, to keep the sicca in circulation in the villages amongst the poor ryotts, for the better purposes of extortion; *salamee* of one rupee for each puttah given;—*extra Peons* when placed over a ryott or his harvest, for collecting kists, or watching the produce before being winnowed;—with numerous petty etceteras legalized by usage, as well as several illegal exactions prohibited by the Government Regulations. The whole of this tending to keep up a spirit of chicanery as practised by the ryotts against the landholders, of pilfering his own *khureean,* and allowing his own field to be *churried.* *Third,* ploughing, the feed of his oxen, or else the hire at two annas per day. And *fourth,* the labour of himself and family engaged in the field.

4. A very small portion indeed of the fields sown in this district with wheat, are irrigated. The *Deerah* and *Chour* lands never. Such of the opulent ryotts as can afford it, do irrigate *Bheetah* lands when the seed first springs up.

A weeding takes place at the early appearance of the plant, and this generally answers; it seldom extends to two weedings.

5. Sowings commence in *Assin* (September,) and continue to *Kartick* (October,) and sometimes extend to *Ughun* (November.) The reapings take place in *Fagoon* (February,) *Chyte* (March,) and *Basakh* (April.) The quantity this district is in the habit of producing, I have not been able, from the minutest enquiries, to ascertain correctly; but calculating from rough statements I have kept for the last eight years, I should say that Monghyr can send down from 50,000 to 60,000 maunds per annum; and there is not the least doubt, if encouragement is given to the ryott, the demands for the Home shipments may be increased. The cultivation could be made to exceed a lac of maunds. Some prejudices must be removed before this point could be gained. I should say the major portion of our wheat finds a market above us for internal consumption.

6. Only with gram, sometimes the borders are run with lin.

7. I annex you a memorandum of prices which I have kept since 1836.

		Opened at.	Closed at.		Opened at.	Closed at.
In 1836	1st qual. Doodeah,..	45 seers	40 seers	1837 to 1842	40 seers	35
	2nd Bagrah,*	47½ do.	41 do.		42 do.	37
	3rd Jummawley,....	50 do.	42½ do.		45 do.	40

These prices are not the bazar rates, but at what I have purchased in the *dehauts*. To this add from 5 to 6 annas per maund for collection, bagging, boat insurance and shipping charges to land in Calcutta.

8. Answered by the 7th paragraph.

9. The wheat of this season has been a general failure in quantity, quality, size, color, and even in taste; and to avoid prejudicing your Society, by such samples, I refrain

* Called also Gungajelly.

from sending any. This much I must remind you of, the good quality of the wheat of this district has been well tested, of which the Strand Mills can well testify.

8*th July*, 1843.

Monghyr, 8*th February*, 1844.

I should have replied to your favor earlier, but was prevented by calls on my farms. At this season, personal attendance is very necessary for the mutual benefit of the peasantry as well as the farmer; this will be a sufficient excuse, I trust, for the apparent neglect. It will always be a source of pleasure to me, to furnish whatever information lays in my power in the capacity of a farmer, which relates to lands, that the Society may at any time require.

Before I answer your queries, a word on the subject matter of Mr. Theobald's remarks, made at the Meeting of the Bengal British Indiàn, Society, held on the 1st instant. I should be sorry if they were allowed to go forth before the public of this country, as well as that of England, uncontradicted. The growing of wheat in this country is not an infant undertaking. It is, and has been, the chief food of the better class of natives from time immemorial; but the careless system of cultivating it, "is in its state of infancy," and will remain so, while this oppressive scheme of taxation (on land) lasts. Mr. T. continues, "*that if the trade were opened, a shipload could not be procured;*" with all deference to this gentleman's knowledge, I would guarantee the filling at least five ships of 400 tons each from this very station alone, from the usual expected out-turns, without any increase of cultivation, or without any detriment to the indigo, opium, or sugar fields. At least 60,000 maunds can be furnished from zillah Monghyr.

Deerahs are lands formed by the influence of Freshes on that side of the river, directly opposite to that where its greatest strength is, and is *first* composed chiefly of sand,

with a mixture, in portions, of muddy-clay. Time and the quick vegetation of a species of birch growing to the height of from 5 to 7 feet, câuses an annual settlement of rich loam, until it forms from 3 inches to 3 or 4 feet in thickness; this ground pays the farmer from 4 annas to 2 rupees per beegah; and the best is good for indigo, wheat, mustard seed, and other grains used by the natives; yields but one crop; is generally inundated in the rains, therefore alluvial ground.

Chour is the natural ground, but lies flat, is subject to inundations, and is influenced by the rising of the river. *Bheetah* is high ground, and never inundated. These two soils almost resemble one another, and strictly speaking, I do not think it to be clay, at least not such as I have seen in Europe. I should call it a loam, of a dark orange color, in this part of India, with a thin surface of dark mould encrusted on it, formed from substances, no doubt, which have consumed on it, and is therefore very rich. The natives are led away with the belief, that wheat does not require a rich soil. *Bheetah* depends solely on the rains and irrigation, and sometimes produces three crops per year of various grains, and the former only one.

I should say a fair average extent of crop will be 10 maunds the beegah of 84 sicca weight, and the following as near the expenses as possible :—

Best ground per Beegah,	Rs.	2	0	0
8 Ploughings for ditto, ...		1	0	0
Feed of Plough-boy, ...		0	4	0
Seed, say 35 seers, ...		1	0	0
Weeding 2 annas, no expense for sowing, ...		0	2	0
Cutting or Reaping, ...		1	0	0

5 rupees and 6 annas for the cultivation of one Beegah, which gives from 4 to 16 maunds. To this should be added the transit

charges from hence to Calcutta, which I have much pleasure in adding for your information; this is from actual shipments :—

To 100 maunds, at 1 rupee per maund,	100	0	0
Dalallie per maund, 2 pice, ...	3	2	0
Kayallee per maund, 1 pice, ...	1	9	0
Bags, 1 anna and 6 pie per bag, 9 : 6; and Cart 2 pice, 3 : 2 : 0, ...	12	8	0
Boat hire 16 rupees; Toll 1 rupee; Oil 8 as., .	17	8	0
Insurance 2 per cent. Fees, and Peon, ...	11	0	0
Rs.	145	11	0

Equal to 1 rupee and 6 annas per maund, deliverable in Calcutta.

Regarding sowing and cutting, no payments in money are paid to the labourers. Say a couple of men or women are sent into the field with the grain, (35 seers for one beegah) they follow the ridging of the plough, and keep casting in the seed until they arrive at the end; whatever remains in their "*cummerbund*" is their perquisite; generally from 1 seer to 2½ each individual receives. In cutting, a nominal system of measurement, I may say, takes place; as the operation of cutting is proceeded in, the younger relatives of the labourers are engaged sheafing the corn; 15 sheafs are stacked on one heap, and one thrown by; this continues until the whole field is completed, the number of ones, is claimed by the reapers, and the fifteens are the property of the grower: these two include the whole expenses of labour.

Replies from Patna. *By* C. J. Muller, Esq.

I have the pleasure to send you answers, the best I can give, to your queries concerning wheat; also specimens of the three sorts of the grain known here.

28th September, 1843.

1*st. On what description of Land, &c.*—Chiefly on high lands not at all, or only very partially, subject to inundation. The best soils for it are *Khewal* and *Dhorus*. The former is clayey, retractive of moisture; the latter is a lighter soil containing a larger admixture of silicious sand than the former.

2*d. What Rent, &c.*—The most common rates in the district of Patna are one and a half, two and a half, and three rupees per beegah. In cases where the soil is particularly fertile, and there are either wells or reservoirs of water for irrigation, together with other obvious advantages, such as proximity to a large market town, the rate may be six or seven rupees per beegah. On the *Deerah* lands opposite to the city of Patna, the rate per beegah is for some fields as high as seven rupees, and this, where there is no irrigation; but then the annual rise of the river renders this unnecessary. These high rates must be regarded as the exception, not the rule.

Wheat is also cultivated on the *Bhowly* tenure, that is where the Zemindar and the cultivator share the crops between them; sometimes in equal proportion; sometimes in a proportion more favourable to the Zemindar: the latter taking nine-sixteenths of the crop.

The beegah now in use in Behar and Patna contains 3,025 square yards, equal to five-eighths of an acre. This is the standard beegah of the Western Provinces, and obtained introduction here when the settlement of resumed *Lakiraj* tenures commenced.

3*d. What is the cost, &c.*—This must vary according to the rent paid for the land; the quantity of land cultivated, and the degree of care bestowed upon the cultivation. It is impossible to give a satisfactory reply to this query. An experienced and intelligent cultivator consulted on the subject, estimates the average cost at two rupees per beegah, (exclusive of rent.)

The quantity of seed sown is from thirty to forty seers per beegah. For the cultivation of ten beegahs, one plough with two or three oxen, as the case may be, are required. The ploughman receives while working three seers of grain a day. His employer lends him from four to seven rupees without interest, and gives him two beegahs of land to cultivate on the *Bhowly* tenure. At the division of the crops, the loan is repaid. It is obvious, therefore, that where the mode of remuneration is so peculiar, no definite sum can safely be put down as the price of labour.

Each ox while hard at work, gets ten seers of *bhoosee*, and one seer of oil cake per diem. The cost of the food varies with circumstances. Where the cultivator happens to be in possession of *bhoosee* and linseed himself, the expense is reduced.

The following is an endeavour to calculate the cost of cultivating wheat land, but it is most probable that in numerous instances, it would be found inconsistent with facts. Cost in cultivating ten beegahs of wheat land :—

Seed, 300 seers, at 12 annas per maund, Rs.	7	8
Rent, at 3 rupees per beegah, ...	30	0
Labour of ploughman and cultivator, ...	9	0
Food of oxen, ...	6	0
Rs.	52	8

4th. Is such Land irrigated, &c.—As a general rule, wheat lands are not irrigated ; but in cases of drought, and where the means of irrigation are at hand, this is of course done.

5th. When is it sown, &c.—It is sown in *Asin* and *Kartik*, (September, October, and November,) and it is reaped in *Phagoon* and *Choyt*, (March and April.)

The extent of the crop is exceedingly various—from 7 to 20 maunds per beegah. From 10 to 15 maunds is a common crop in good soils, in good seasons.

6th. Are other crops sown, &c.—Generally speaking, wheat is grown alone, but it does occur occasionally, that gram, *kirao,* (Pisum arvense,) or *musoor* (Ervum lens) is mixed with it.

7th. At what rate, &c.—All that can be said in reference to this question is, that the best wheat in the Patna market may be had at from 14 annas to 1 rupee per maund of 40 seers, at the proper season. It is cheapest in the months of *Chyt, Bysakh* and *Jeth,* and dearest in *Asin* and *Kartick.* The cost of carriage, &c. must vary according to circumstances.

The following tables give the average price of wheat for the last 10 years, compiled from monthly records:—

No. I.

Year.		*Price.*			
1241,	Fusli,...	35	seers,	.562	decimal, per rupee.
1242,	„ ...	35	„	.579	ditto.
1243,	„ ...	35	„	.425	ditto.
1244,	„ ...	37	„	.770	ditto.
1245,	„ ...	41	„	.479	ditto.
1246,	„ ...	41	„	.354	ditto.
1247,	„ ...	48	„	.875	ditto.
1248,	„ ...	38	„	.833	ditto
1249,	„ ...	36	„	.875	ditto.
1250,	„ ...	42	„	.916	ditto.

No. II.

Year.		*Lowest Price.*		*Highest Price*	
1241,...	1 maund,	2	seers per rupee,	30	seers per rupee.
1242,...	1 ...	$3\frac{3}{4}$	ditto,	25	ditto.
1243,...	1 ...	6	ditto,	$30\frac{3}{4}$	ditto.
1244,...	1 ...	$5\frac{3}{4}$	ditto,	25	ditto.
1245,...	1 ...	$2\frac{1}{2}$	ditto,	27	ditto.
1246,...	1 ...	5	ditto,	28	ditto.
1247,...	1 ...	$2\frac{1}{2}$	ditto,	23	ditto.
1248,...	...	36	ditto,	24	ditto.
1249,...	...	39	ditto,	20	ditto.
1250,...	...	36	ditto,	$22\frac{3}{4}$	ditto.

It will be perceived that it has been dearer during the last three years, than in the seven preceding ones. At this moment the price of the best wheat is 25 seers per rupee.

8th. How many descriptions, &c.—There are three distinct varieties, namely: the Bunarsi, the Doodiya and the Lall, placed here in the order of their excellence. The samples forwarded, will enable the Society to judge of their respective merits.

NOTE.—Estimating the weight of a quarter of wheat at 468 lbs. avoirdupois, which is equal to 5 maunds, 27 seers and 8 chittacks, and taking the Indian price at one rupee per maund, the value of a quarter of wheat here, is five rupees and eleven annas, which at 2*s.* per rupee is equal to 11*s.* 4½*d.*

Replies from Goruckpore. By J. H. BRIDGMAN, Esq.

At the time I received your letter of the 15th of June last, addressing to me a series of inquiries on the subject of the cultivation of wheat, I was too ill to be able to reply to it. Subsequently the length of time which had elapsed, and the belief that I could furnish you with no information of importance, led me to think that a reply was no longer necessary. A repetition of the queries, however, forwarded to me a short time ago, shewing that information is still considered desirable, I write to answer them in the best manner I am able; but rather that I may not be thought indifferent to a question of great importance, than with the hope that I can communicate any thing of any value. I reply to the questions *seriatim* :—

1. On strong sandy loam.

2. In Goruckpore the rent even of the best soils varies according to the abundance of population in the neighbourhood; large tracts being still waste or under forest. It may be taken at from 1 rupee per *acre* in the more remote parts, to 4 or 5 per *acre*, in the better populated parts of the district.

3. If done by hired labour it costs 7 rupees to 10 rupees per acre, *exclusive* of rent, when cultivated *chowmass*, as the native term is, *i. e.* ploughed during the four months of the rains, without any other crop being taken off it during the season. But wheat is often sown after a crop of the early rice has been cut. Such a crop is in general inferior, but it must be very cheap; and on some of the newly recovered soils, it is as fine as the most laborious cultivation can make it in other places.

4. In the northern parts of Goruckpore, lands lying in low situations are never irrigated for wheat. The higher lands are so if water is at hand, but not more than once, unless the season is unusually dry. In no case however does irrigation appear to be considered indispensable, and it is always practised with caution, being considered to tend to produce the red blight in wheat and barley.

5. It is sown in October, and reaped in March or the beginning of April. I believe about 16 Calcutta bazar maunds per acre would be considered a fair crop, but that half as much again is not infrequent.

6. Barley is often sown with wheat: the mixed grain is called *Goojaee* or *Goojéï*. Surson, or the large yellow mustard seed, is also often sown with it; but the seeds are not mixed, the surson being pulled before the wheat is cut.

7. Probably at from 1 rupee 8 annas to 1 rupee 12 annas. In ordinary seasons the price is generally 1 rupee to 1 rupee 4 annas per Calcutta bazar maund in the markets, and 8 annas more would, I apprehend, be enough to cover the cost to Calcutta.

8. The only kind I have seen in Goruckpore, is a red wheat of rather small grain. It bears a lower price than the doodhee wheat of Behar, but I have understood that it is preferred by the natives generally, as being sweeter in flavor and more wholesome.

December 17, 1843.

Replies from Benares, by G. WYATT, ESQ. *Communicated by* D. F. McLEOD, ESQ.

Herewith I have the pleasure to enclose a paper of replies by my Deputy Collector, Mr. G. Wyatt, to the Queries of the Society, regarding the several kinds of wheat grown here; together with specimens of the two principal varieties. I fear these may be too late now to be of service, and regret the paper has been so long delayed, but forward it on the chance of its proving yet in time.

December 30, 1843.

---

1. In the district of Benares, wheat is grown chiefly on the best soils, which are pure clay with a very slight admixture of sand and the alluvion deposits on banks of rivers. The first, when well manured and watered, yields the largest produce, but is expensive:—the other is almost equally fertile, but less expensive to prepare, owing to natural richness of soil and moisture from recent submersion.

2. On an average, 4 rupees per beegah. The beegah is a local measure of land, fixed in this province by regulation, at 3,136 square yards, or 64,793 of a statute acre.

3. One maund seed, at 21 seers,	... Rs.	1	12	0
Ploughing, 12 times at least,	... ...	3	0	0
Two waterings, ...	... ...	1	4	0
Rent to Landlord, ...	... ...	4	0	0
Total per beegah as above, ...	... ...	10	0	0

4. Except in "*kàchar*," or alluvial land, wheat cultivation is always watered; invariably once and sometimes thrice, according to facilities for irrigation, dependent on depth of water in wells, or proximity of the field to nullahs or tanks, and the means of the cultivator, and abundance or otherwise of previous rains.

5. Sown in all October, and reaped from middle of March to middle of April. Average produce 12 maunds.

6. During the "*rubbee*," or October sowings, are grown,—gram, barley, pease, musoor dal, linseed, surson or mustard, safflower, (used as a dye, and the seed for oil.)

MEMORANDUM.

The enumeration in *justa position*, shews the crops that are grown at the same time, but *not in the same fields with wheat.* Safflower alone is frequently sown with wheat, as the plant is stronger, and takes a longer time to come to maturity. In alluvial soils, however, when the grain is intended solely for the use of the Agriculturist, all these grains are commonly mixed and sown together.

7. The average of the past five years gives the market price of wheat in the city of Benares, as follows: 1st quality 20 seers of 80 Rupees the seer, 2d ditto 22 seers per rupee. The *Muhajunee* allowance of transporting wheat from Benares to Calcutta, is from 28 to 30 rupees per 100 maunds.

8. There are but two distinct kinds of wheat, known as red and white, or inferior and superior. The first is the bearded, and the second the *beardless* wheat; red wheat is less useful than the white; as the latter contains more gluten, and from it are prepared *myda* and *soojee.* It also keeps longer than the red wheat.*

9. One specimen of each kind is herewith sent for the Society's inspection.

GEO. WYATT.

Replies from Allahabad and Allyghur. By J. O. B. SAUNDERS, ESQ.

I had the pleasure of receiving your letter with the queries of the Society regarding wheat. I am rather hurried preparing for my departure to Allyghur to-morrow, but send you replies drawn up as well as I can, though rather in

* This I think must be a mistake, and is not admitted by the Natives with whom I have communicated.—D. F. McL.

haste. From Allyghur I shall send you samples of the wheat of that district. I fear they will reach you too late for your purpose. My reply to the 3rd Query as to the cost of cultivation, assumes the lands to be cultivated by hired labour; but to the farmer engaged in the cultivation of all the crops of the country with his own implements and feeding his own cattle from the produce of his own land, the expense is by no means so much. It would take me some time to obtain the requisite information to give a good estimate of this, which is however the correct method of estimating the cost of production to the ryot. The price currents of the several districts for some years past would perhaps be as useful a document as this, for the object the Society has in contemplation. I do not think the cultivation of wheat can be extended beyond what it now is in the Doab, in consequence of the poverty of the people, the effect of the present unfortunate revenue system superadded to bad seasons, and the successful competition of other countries in the production of the only staples of export of the Doab,—cotton and indigo; unless indeed the long-talked of Ganges canal was completed, which would not only admit of extension, but would enable the cultivator to produce wheat much cheaper.

I propose returning to this place about the end of January; in the mean time I remain at Allyghur, from whence I shall be happy to give you any further information I can obtain.

Allahabad, 25th November, 1843.

ALLAHABAD.

1. The soils preferred for wheat are clayey, and the alluvial lands, (Cachar) of the Ganges, which are principally of strong clay, inundated every year.

2. The rent paid by the ryot for good high land is five rupees per beegah, and six to seven rupees of the *Cachar* lands; the beegah is 3,025 square yards.

3. The cost of the wheat cultivation where all labour is hired, is 17 rupees and 8 annas for the high lands, which require more irrigation. For the *Cachar* lands 6 rupees, the produce of which is considered to be of inferior quality.

4. The high lands three to four times, as the season may require; the low lands once or twice; many of these do not require irrigation.

5. Sown early in October and reaped in March; good produce estimated at sixteen Calcutta bazar maunds, but the return is oftener less than more.

6. Only in the inferior lands is any other seed grown along with wheat, generally mustard or safflower.

7. Wheat sells ordinarily in this district at twenty to twenty-two seers local weight per rupee, or twenty-seven to thirty and three-quarter Calcutta bazar maunds; at this rate wheat would cost 2 rupees and 4 annas to 2 rupees and 8 annas per Calcutta bazar maund landed in Calcutta, including bagging, exchange and insurance; a demand arising for export of any consequence, would raise the price immediately.

8. There are three descriptions of wheat grown in this district: the red, the white, or *doodee*, and the *moowoah*, a wheat without beard; of the latter very little is grown: the white is the favorite. The ryots very often sow the red and white wheat seeds mixed through indifference.

I have the pleasure to send by dāk banghee, a sample of each quality.

I find there is another kind of wheat grown on the banks of the Jumna called *kutea*, a coarse, large grained wheat, considered inferior, and sells somewhat lower than the others. I have not been able to obtain a sample of it at this moment to send along with the others.

Allygurh.

1. The soil of this district is light, and rather sandy.

2. The rent is one rupee to 1 rupee and 4 annas per cutcha beegah for the best lands; about 900 square yards.

3. The cost of cultivating by hire would be 6 rupees, including seed and rent.

4. The land is irrigated four or five times.

5. Sown in the end of October and beginning of November, reaped in April.

6. Mustard is almost always sown with it.

7. Wheat sells in this district at twenty-eight seers per Calcutta bazar maund, and would cost nearly 2-12 per Calcutta bazar maund in Calcutta.

8. The red wheat is almost the only kind grown, there is a small cultivation of *doodee*, the impression being that the former is much more productive in the field, and less subject to suffer from frost and blights ; the white sells a little higher than the red, the difference being one seer in the quantity sold per rupee.

Replies from Lucknow, Fyzabad, and the Central District of Oude. Communicated by Captain G. E. Hollings.

I have the pleasure to acknowledge the receipt of yours of the 17th instant, and in reply, to forward the answers that I have been able to obtain regarding the cultivation of wheat, in the immediate vicinity of Lucknow. I have had the questions forwarded by you properly translated, and intend to send copies to different districts in Oude, and will send the replies with as little delay as possible.

I might as well state here, that the great grain districts are in what is called the Ganjur country, (literally low lands,) situated between the Chaka river and the Gogra, and from the Gogra to the Teraee.

You may recollect, that in one of my first letters I promised to supply you with such information as my personal

experience afforded, or I could collect from what I considered authentic sources, regarding the Agricultural capabilities of Oudh, but I have found so much more difficulty in making out the paper than I had anticipated, that I have hitherto been unable to fulfil the promise; you may however rest assured, that I will do so as soon as possible; for I am of opinion, that the two most important points to be considered in the consolidation of our Indian empire are, the encouragement of *one* language to be used throughout all our possessions, and the development of the natural products of the soil; always supposing that efficient measures have been, or shall be adopted for the security of life and property, towards the accomplishment of which the recent appointment of uncovenanted Magistrates in Bengal, is a most important step.

I hope to be excused for introducing subjects which may by some be considered extraneous to the point immediately under discussion; but I have so accustomed myself to associate all the subjects that I consider of nearly equal importance as regards the rulers and the people of India, that I find it nearly impossible to confine my attention to a single point. To return to the growth of wheat. I beg to state that the land near the city of Lucknow, from its position and the avoidance of expense of carriage, affords great advantages for the cultivation of all articles of consumption required for the daily use of its comparatively enormous population, and consequently is subjected to a higher rent than that of the more distant provinces. But it cannot be disputed, that the assertion of a correspondent of the *Calcutta Star*, backed by the opinion of the Editor, regarding the superior fertility of the Trans-Gogra provinces, which extend through the Teraee to the Nepal frontier, is perfectly correct. To give you some idea of the difference, I need only mention, that I have myself purchased at Toolseepoor, which is a district on the Nepal frontier, wheat at

fifty seers of ninety-six rupees each seer, and gram at fifty-four seers per rupee, when the former grain was selling at seventeen, and the latter at twenty seers for the rupee at Lucknow. I was in or near the Teraee in May 1839, at different periods from April to November 1840, and from the commencement of March to the end of May 1841.

The returns which I hope to be able to forward to you in a month or six weeks, will show what the difference of production now is. In the mean time, I beg to suggest, that if a body of merchants, assured of protection by the British Government, were to send properly qualified persons to the jungles in the vicinity of the Khyreeghur and Khunchenpoor districts of Oude, they would be able to purchase all the materials for boat building at very moderate rates; the iron is supplied from Nepal, and forest trees, *sissoo, sakoo* and *toon* of every description, properly seasoned, could be procured to any extent; there would be no deficiency of materials to make sails and ropes, and grass for *chappahs* could be obtained without the slightest difficulty. The river Gogra passes through the most productive country in India for grain of every kind, hemp, and opium! As immense herds of cattle are pastured in the neighbourhood of the Teraee, a most profitable trade could be carried on in horns and hides; in addition to which, the finest sugar can be procured in some parts of the Oude dominion. The capital of Oude is unfortunately situated on the Goomty, a river which affords very trifling advantages with regard to navigation and commerce; but I am convinced that any of our river Steamers could go up the Gogra quite through the Oude dominions, and as far as the frontier of the Shahjehanpore and Bareilly districts. The boats built at Khyreeghur, or Khunchenpoor, could drop down the river Gogra, and take in their cargoes of grain at any station on the banks. The most favorable position for a general magazine would probably be Secrora, because there is a large market at that

station, and all the products of the districts in or near the Teraee are brought to it; besides, it has the advantage of water communication with the Gogra.

I have sent for samples of wheat from different parts of Oude, which shall be forwarded to you as soon after receipt as practicable.

Before concluding this letter, I beg to assure you, that as far as the collection of information goes, I shall always be really happy to render myself useful to the Society, which, I am firmly convinced, in spite of the damper that has been thrown on its exertions by the withdrawal by the Indian Government of the power of franking letters and parcels of seeds, will prove of infinite benefit to the country: and so long as I am associated with it, I shall consider it my duty to be one of its active members.

Lucknow, 26th November, 1843.

Replies from Lucknow.

Rich arable land, called by the native *mutteearah,* which retains water, is the best for sowing wheat; but it is necessary to apply manure to it. Water that is brackish, or taken from tanks or rivers, is better for such ground than common well water.

The rent for such ground as is described above, is at the rate of eight rupees per beegah of sixty yards square.

The cost for cultivating wheat land, including seed and rent, is 23 rupees 10 annas 8 pies per beegah, namely:—

	Rs.	A.	P.
Rent, ...	8	0	0
One maund of seed equal to 48 Calcutta seers, ...	1	10	8
Irrigating four times, that is, once a month during its growth, ...	5	0	0
Ploughing, &c.	9	0	0
Total, ...	23	10	8

Wheat is sown in the middle of the month of *Kartick*, about the end of October, and reaped in the middle of *Choit*, about the end of March. The extent of crop in Calcutta bazar maunds to be expected from such land, is 24 maunds, or 20 maunds Lucknow weight, the value of which is, ... Co's Rs. 23 5 4

Mustard, from which oil is extracted, is sown with wheat, about half a seer in a beegah, and nearly three maunds may be expected as a crop, which may be valued at 7 or 8 rupees, exclusive of what is obtained from the sale of wheat.

Good wheat from Lucknow could be landed in Calcutta at the rate of 24 seers, Calcutta weight, for a rupee, according to the following calculation:—

Expense of sending	Rs.	A.	P.
1000 Lucknow maunds of wheat to Calcutta, prime cost, ...	1,666	10	8
Boat hire and servants, ...	200	0	0
Insurance and contingent expenses, ...	133	5	4
Total, ...	2,000	0	0

As 1000 Lucknow maunds are equal to 1,200 Calcutta ones, the wheat could be landed in Calcutta at 24 Calcutta seers for a rupee. It will be observed, that I have only mentioned the prime cost and expenses of conveyance; a fair allowance must be made for the merchant's profits, before it can be ascertained at what price wheat could be sold in Calcutta.

Two descriptions of wheat are grown in Oude; white, called by the native *seeata;* and red, which is called *lullia.* The white wheat is much preferred to the red.

Answers regarding the cultivation of Wheat at Fyzabad.

1. *Muteearee* ground which is not sandy, is useful for sowing wheat.

2. Rent for a pucka beegah of land, is 7 rupees 8 annas: sixty square yards make a pucka beegah.

3. The cost of cultivating land for wheat including seed and rent, is as follows:—

	Rs.	A.	P.
Ploughing, (thirty times,)	2	0	0
20 Seers of seed, ...	0	12	9
Rent, ...	2	8	0
Manure, ...	0	8	0
Irrigating, ...	0	10	0
Cutting and separating grain from straw,	0	14	3
Total, ...	7	5	0

4. Such ground as is described above, is irrigated twice from the time of sowing till harvest.

5. Wheat is sown in the month of *Kartick*, (the middle of October to the middle of November,) and cut in *Choit*, (last half of March and first half of April,) seven maunds thirty-two seers and three chattacks of crop in Calcutta weight is expected from a beegah of land.

6. Barley and peas are mixed with wheat crops.

7. If the wheat sent from Fyzabad be sold at Calcutta at the rate of twenty seers two chattacks, (in Calcutta weight,) per rupee, it will bring neither loss nor gain.

An account of expenditure for conveyance of wheat from Fyzabad to Calcutta and the value:—

	Rs.	A.	P.
500 Maunds of wheat, Lucknow weight, purchased at the rate of 25 seers per rupee at Fyzabad, ...	800	0	0
Boat hire, ...	230	0	0
Loading wheat on the boat and oil for light,	3	0	0
A Sepoy's Pay, ...	15	0	0
Custom on account of Permit, ...	40	0	0
Ditto to pay the Zemeendars and others on the road, ...	75	0	0
Total, ...	1,163	0	0

N. B.—500 maunds of wheat in Lucknow maunds, or 585 maunds 14 seers 1 chattack in Calcutta weight, sold at the rate of 20 seers and 2 chattacks per rupee at Calcutta, makes 1163 rupees, as mentioned above.

N. B.—The above account was furnished by a native who did not know the purpose for which it was required. The items for boat hire, sepoy's pay, permit and Zemeendaree appear extravagant, and as the bank of the Gogra opposite to Fyzabad belongs to the Company, arrangements might be made to reduce the expense of carriage. It will probably be sufficient for those who are interested in the growth of wheat in India, for the purpose of supplying the English market, to know, that the price for which wheat can be grown at Fyzabad, which is situated on the Oude frontier, is 25 Lucknow seers of ninety-six rupees weight each, for one rupee. (True Translation,)

G. E. Hollings.

Answers regarding the culture of Wheat in the Bainswarah or central district of Oude, situated between the Ganges and Goomty, to the South and West of Lucknow.

Wheat is sown in three kinds of land in this part of the country.

1. *Muteearee,* which if close to a village, is called "*gohan,*" and is easily irrigated and manured; and if far from the village, is named "*burhut,*" and water and manure are procured with great difficulty.

2nd. *Domut,* and 3rd *bhoor,* which are most valuable when they are close to the village, because they are easily irrigated and manured.

The rent for a beegah of *muteearee* land of the 1st kind, 5 rupees; 2nd, 4 rupees; and 3rd, 3 rupees.

Ditto *domut* of 1st kind, 6 rupees; 2nd, 5 rupees; and 3rd, 3 rupees.

Ditto *bhoor,* 1st kind, 2 rupees; 2nd, 1 rupee; and 3rd, 8 annas.

The *muteear* and *domut* land where vegetables are sown, rent from 8 to 16 rupees per beegah, and the *bhoor* land from 3 to 5 rupees; sixty square yards make a beegah.

The cost of cultivating a beegah of wheat land, including seed and rent, is as follows:—

Muteearee Land.

	Rs.	A.	P.			
Rent, ...	5	0	0			
Ploughing, ...	2	12	0			
Seed, 40 seers, ...	2	0	0			
Coolies, ...	0	6	0			
Watering, ...	3	12	0			
				13	14	0

Domut Land.

	Rs.	A.	P.			
Rent, ...	6	0	0			
Ploughing, ...	2	12	0			
Seeds, ...	2	0	0			
Coolies, ...	0	6	0			
Watering, ...	3	12	0			
				14	14	0

Bhoor Land.

	Rs.	A.	P.			
Rent, ...	2	0	0			
Ploughing, ...	2	0	0			
Seeds, ...	2	0	0			
Coolies, ...	0	12	0			
Irrigating, ...	2	0	0			
				8	12	0

If there is rain in the month of *Ughaun*, (half November and half December,) such lands are not irrigated; and if not, the *muteearee* and the *domut* lands are irrigated three times, but the *bhoor* only twice. Wheat is sown in the middle of the month of *Kartick*, (October,) and cut during the month of *Choit*, (March.)

Fifteen maunds of crop in Calcutta weight is expected from the *muteearee* and *domut* lands, and eight maunds from the *bhoor* ground per beegah. Grain (or *chuna,*) barley, and pease, are mixed with wheat crops.

(True Translation.)

G. E. Hollings.

Replies from Agra. By H. Hamilton Bell, Esq.

Your circular letter requiring such replies as I could give to several queries respecting the cultivation of wheat in these provinces, reached me when absent from home, and without the ability of referring to some memoranda I had made on the subject, and subsequently, occupation during the indigo season, prevented my acknowledging and replying fully to your letter.

The districts with which I am practically acquainted, are Allyghur, Mynpooree, Muttra, Etawah, and Agra, on the left bank of the Jumna. In all of these, there is considerable diversity of soil, and much difference in the productive power of the land; but so far as my observation and enquiries go, excepting in rare instances, there is little selection of soil for the cultivation of any description of grain further than that of the *rubbee* crop. Wheat is invariably sown in the lands which admit of irrigation, whilst barley and gram are frequently sown when this is impracticable. The relative proportions of irrigated and unirrigated land vary considerably throughout the districts; but generally, the whole of those enumerated are very well off for water on this side the Jumna. When the well water is brackish, wheat is sown above the general proportion, the produce being considerably larger and less subject to blight; but this land cannot be cultivated unless the rains have been sufficient to admit of the seed germinating without irrigation from the wells. I have no chemical knowledge of the component parts of the soil.

The natives generally class it, as *bhoor* or sandy, *muttyar*, a good stiff soil, and *chiknoh* or clay, and these have several subdivisions dependent on the proportion of sand or clay. In Mr. Mansell's able report on the late settlement of zillah Agra, the analysis he procured is said, though not minutely accurate, to afford a fair general character of the component parts of the soil. *Bhoor* is thus described as consisting of 7-10 silex, 3-10 alumina and little vegetable matter; *muttyar*, 6-10 silex, and the rest alumina and vegetable matter; and *chiknoh*, 1-3 silex, a small proportion of carbonate of lime, and vegetable matter. The first of these soils is light, but not unfertile by any means, and yielding good crops of the *khureef* grains. The two latter are more suited for the *rubbee* crop of wheat, &c.; but all are indiscriminately used if irrigation exist.

It is not easy to specify the rent per beegah of any particular *khet*, (piece of land,) as it is very much the practice to include the whole of a ryott's cultivation in one pottah at an average rate, assigning him some land near the village, some at a medium distance, and some towards the boundary. In my best villages, this scarcely exceeds 1 rupee per cutcha beegah, of 8268⅓ square feet, something less than 1-5th of an English acre, and I should think this (at 1 rupee and 4 annas,) a not very unfair average for wheat; as in the latter lands near the village, where the rent would of course be highest, if let singly, a double crop is frequently, if not generally, taken. For example, near Omerghur, indigo sown in April and May, and cut in August or September, is generally followed by wheat or barley, sown in November, and cut in March.

The cost of cultivation of wheat cannot be confidently stated. Hired labor is not general, or even common. Frequency of ploughing is thought of great consequence in wheat crops, and this may vary from 6 or 7 to 20 times under favorable circumstances of weather. If done by hired labor, it would cost 1 anna per cutcha beegah each plough-

ing; but such rate can hardly be assumed as part of the cost of productions to a *kisan,* who performs the work himself, and who, if not thus engaged, would pass his time in idleness. Some of the lower castes in addition, use a good deal of manure, carried on the head in baskets. The higher castes will not do this, and it is therefore difficult to state any particular practice as general, though more or less prevalent according to the caste and means of the cultivator. The proper quantity of seed is considered to be 10 local seers=to about 25lb. English per cutcha beegah of 8268⅓ square feet; but the poorer cultivators frequently diminish this about 1-3d. Since the famine year, which I exclude, I should imagine 23 to 25 seers of 510 rupees to the *pansera,* the average village price of wheat, and previously to that, 30 to 35 local seers since my residence in these provinces; though varying more than one would suppose, from greater or less proximity to considerable markets of consumption. At 25 seers per rupee, the seed would therefore cost rather less than 6½ annas per cutcha beegah. After frequent ploughing, weeding is scarcely required. From three to five waterings are generally given according to the ability of the *kisan,* and dependent in some degree, of course, on the weather, which sometimes is rainy for a few days in December and February, and according to this is the out-turn of the crop. I may remark here that irrigation is far more conducive to fertility than rain water. I do not know how to state this as a money charge; for a cultivator cannot get it done for him by hire. When it has been a great object for me in my indigo and cotton cultivation, I have sometimes, in my own villages, induced the people, reluctantly, though unenforcedly, to assist me at from 4 to 8 annas per cutcha beegah; but have been frequently absolutely refused by those who know I should not resent their conduct. One pair of good stout bullocks will, near me, where the water is about 32 feet from the surface, irrigate 15-20 of a cutcha

beegah per diem, requiring one man, woman or lad to the bullocks; one man to the leather bucket; and one to distribute the water equally to the different beds. I may mention here, that it is much the practice when the soil contains saltpetre, or when the manufacture of the article has prevailed, to scatter the saltpetre earth, broad cast, over the young wheat when about 4 to 6 inches high, and this beyond all question, is of great importance. The plant is more healthy and vigorous, less liable to blight, and considerably more productive. The wheat is always cut, partially, by hired labor. This is almost invariably paid for in kind, either so many seers per beegah, or the 20th sheaf. It is difficult to estimate this in money, but the charge may be excluded from any calculation by diminishing the crop 1-5th.

The ryotts begin to prepare the lands for wheat according to the previous crop. If there have been joar, bajro, or cotton, the ground is clear of them in November, December, and January; and this is subsequently ploughed as rain may happen to fall, and during the rains when the *kisan* has leisure, and the soil admits of the operation. These lands always afford the best crops, and yield an average of 3½ to 5 local maunds per cutcha beegah, (and land well cultivated when the saltpetre earth broad cast is used, rarely less than the last,) or about 360lbs. to 510lbs. English weight. When wheat is sown after an early *khureef* crop from the land, the return is diminished certainly 1-3d, and, perhaps, nearly one half. A much larger produce than this is sometimes obtained, and in my memoranda I have returns, on which I believe dependence may be placed, as high as 10 local maunds per cutcha beegah, equal to 1020lbs. English, *or about* 83 *bushels per acre!* In villages where part of the lands are of such fertility, the fields are let separately, and the rent is from 2 rupees and 8 annas to 3 rupees per cutcha beegah. From one of these I send you a small sample of last year's wheat, which is rather injured by the weevil, and

a small quantity of the earth from one of the *kets,* dried in the sun and pulverized, lest you should wish an accurate analysis.

The best ryotts rarely sow any other seed with the wheat, with a not uncommon exception of a line of mustard at varying distances, perhaps generally 20 yards. The leaves of this are gathered as green fodder for the cattle, the chief inducement, I imagine, to the cultivation, and the stalk remains to flower and go to seed, gathered after the wheat is off the ground. In almost every village there are some few *khets* in which barley and wheat are sown intermingled, but not to a great extent.

The price of wheat in this part of the country, I have already stated to be about 32 local seers, or nearly 1 Calcutta bazar maund per rupee in fair seasons, in which the produce of the *khureef* crop is the most influential regulator of the market. I have never dispatched any to Calcutta, but I have sent down mustard seed; and examining the same charges, these would, as nearly as may be, amount to 1 Rp. per Calcutta bazar maund. It is therefore extremely unlikely that wheat will ever be sent from hence, unless, at the lowest rate, 2 rupees per maund can be relied on. There seems little surplus produce under common circumstances, and an external demand would advance the price, even if of very moderate extent. The usual average price pays the cultivator, of course, but I do not suppose above the common returns of capital. I should remark, that any estimate of monied cost to the cultivator is very fallacious; a great proportion of the ryotts cultivate on advances of seed, cattle, and subsistence, or at all events some one of these. The first is given at a premium of 25 per cent. added to the cost price of the day, and repaid in grain at a small allowance in favor of the lender, or a rate fixed on a particular day, when the probable out-turn of the crops may be estimated. I should imagine, that 1½ for 1 in kind is a very light average. *Tukha-*

wur is a money charge, and in this cattle may be included, settled from the crop at the same advance of 25 per cent. The whole of these vary according to circumstances and the condition of the village; but they are exacted when ryotts are in excess, and remitted when tenants are scarce; according as the parties may agree. There are also a variety of *hukks* of different members of the old village communities, (as carpenter, blacksmith, &c.) yet in nominal existence ; and collectively, these would amount to nearly seven maunds per plough, or fifty cutcha beegahs. It does not seem obligatory to employ these people, though the Zemindar usually endeavours to impose this to get his own work done for nothing, and it may be said, that it is merely a payment for service received; but it is specially attached to the cultivation: and besides these, there are a variety of *hukks* for which no consideration is given, all being in fact a charge on the produce, which it would be difficult to guess at, even approximating, as a money charge. In my village, so far as I know, the people are left to their own arrangements; but although they know and waive all such demands, I have no doubt they pay something for this to the Gomashtahs, though I have had no complaint of any exaction. An opinion of the rate at which the *kisan can* cultivate may, however, be formed, from the undeniable fact, that wheat is grown to a very considerable extent in poor and *dofuslee* land, for a gross return of 3 rupees 5 annas and 4 pie per cutcha beegah, assuming the village price at 30 local seers per rupee. From this if we deduct one rupee as the general average rent of such land, we leave two rupees five annas and four pie as the return for seed, labour, and agricultural profits ; and this must of course, pay the ryott, or he would relinquish the cultivation. With this fact before us, it is exceedingly difficult to account for the disproportionate monied rents of the superior lands. In those I have noticed, the gross returns of 5 maunds and 10 maunds would be 6 rupees 11 annas and

8 pie, and 13 rupees 5 annas and 4 pie respectively, and yet the only difference in cost of production would appear to be the difference of rent, at the *utmost* stated as 2 rupees.

I am only aware of two descriptions of wheat sown here, and these are frequently mixed. I do not believe there is any difference in the produce per beegah, or price, excepting on an occasional demand and short supply of the white, the flour of which is preferred, from its colour, for some Hindu preparations of food for their festivals. I send musters of each description.

I think you will be struck with the great produce obtained under what is considered generally the very imperfect, certainly quite unscientific, agriculture of this country. There is no doubt from all I can learn, and what I myself perceive, that land to any extent may be met with where the return, on good native cultivation, would be not less than 43 bushels to the acre, allowing 60lbs. to the bushel, and this is far above the average of the North American States, which cultivate so extensively for export. The object of your inquiries, I infer, has advertence to the ability of these provinces to supply an extraneous permanent demand with reference to increased returns for the home markets from this country, when the corn laws no longer paralyze the manufacturing and commercial industry of Great Britain. We have, however, here the petty, peddling interferences in details, of the present revenue system, nearly as pernicious; and till this is got rid of, and the land tax is made permanent, the resources of this country will never be fairly developed.

28th November, 1843.

Replies from Agra. By T. J. Finnie, Esq.

I am glad to see the Agricultural Society taking active measures to extend the export trade of this country by creating a market for its agricultural products, which is the only

means by which a stimulus can be given to agricultural improvement. I have long been surprised that the loud cry in England for cheap bread was not hushed by large importations, which, under judicious management, might be made from this, too much neglected, and too lowly estimated dependency of the British crown.

I have the pleasure to inform you, that in addition to my general observations upon the wheat cultivation in a great extent of country through which I have had occasion to travel in India, I have made particular and careful enquiries among the people themselves, who are engaged in wheat cultivation, and I think that when it becomes generally known that a foreign market is open to it, there will be no difficulty in supplying England with all the bread it may desire from India. You cannot depend certainly upon the crop from Allahabad to Delhi, until the means of irrigation is afforded by the completion of the Ganges Canal; but complete that, and the Dooab might be made the granary of England, and also the parts of India that might be visited by drought and consequent famine.

I must apologise for the delay in answering your questions, but it was in consequence of having to visit the interior of the district, which opportunity I took to gather more detailed information than I could otherwise have afforded you. This district must not be considered a fair criterion by which to form an opinion of Indian agriculture, for of all dry places, this is the driest. But such facts as I have gathered, I submit in reply to your questions.

1. Wheat is cultivated in several different kinds of land, distinguished by peculiar native names which differ in almost every purgunnah; but I have observed, and the people say, that the land which contains the most clay is the best wheat land, because it retains its moisture longer than if much mixed with sand. The kind upon which wheat is cultivated in the zillah of Furroh near Agra, is called *domut*,

chicknah, murloh, kossah, and roteah, all of which are so nearly alike, that an ordinary observer would not distinguish them.

2. The ryott pays a rent of from 3 to 3½ to 4 rupees per beegah of 52 yards square, and consequently containing 2,704 square yards.

3. The cost of cultivating wheat land, when the labor is performed by the ryott and his family, is comparatively trifling, being only about 6-8 or 7 rupees per beegah, including seed, and then he can usually make a handsome profit; the yield altogether being usually about 20 rupees: but when *hired* labor is resorted to, if the hire is paid in money at the lowest village rates, the expenses would be 28 rupees: being a loss of 8 rupees. I mention this fact to shew the utter impossibility of even the natives cultivating land at a profit with *hired* labor, and Europeans have to pay higher wages, and are more imposed upon than natives are.

4. The land is irrigated six or eight times during the growth of the wheat.

5. Wheat is sown from the middle of October to 10th or 15th of November, and is reaped during the month of May, extending frequently to the first week in June, and yields from 8 to 12 village maunds.

6. Mustard, or "*surson*" and *teesee* (flax), are usually sown with the wheat.

7. Pretty good wheat can usually be purchased in the villages where it is produced at 1 rupee 4 annas per maund, of 40 seers per maund, and 80 rupees weight to the seer. (I have not the tables to convert it into Calcutta bazar maunds.) It would cost about 8 or 10 annas per maund to Calcutta from Agra, and about 2 annas would bring it from the district to the river, at which rate the Moffussil maund could be landed in Calcutta at 2 rupees per maund.

8. There are two descriptions of wheat grown here, one is called red and the other white wheat; the red is the favorite

among the people, because they say it produces the most grain. The wheat grown east of the Jumna, is better than that grown west of the river, and appears to improve as it advances east, as the Rohilkund wheat is the best I have seen.

9. I have the pleasure to send you a sample of the two qualities produced at Furroh.

Agra, 30th December, 1843.

Replies from Budaon. *By* JOHN DONALD, ESQ.

I am now able to reply to the questions received with your letter of the 18th ultimo.

1. The cultivators of this district prefer the *doomut* land, containing a mixture of sand and clay, for sowing wheat, but they do not, apparently, confine themselves to any particular description of soil, merely changing the crop from *khurreef* to *rubbee*.

2. About 8 annas per kucha beegah of 1,008 square yards, (4 b. 16 c. go to an acre,) may be taken as the average rent paid. The rates vary, of course, according to the quality of the land, and the industry of the ryots; for instance, the *Moorraos* pay much higher than other castes, as their cultivation lies principally round the villages, and in the vicinity of towns.

3. Per kucha beegah the result will be

Seed, 7 : 8, ...	Rs.	0	4	0
Rent, ...		0	8	0
Ploughing, ...		1	8	0
2 Waterings, ...		0	8	0
Cutting and thrashing, ...		0	5	0
				3 Rs. 1 Anna

yielding from $2\frac{1}{2}$ maund to 3 maund 20 seers of wheat, besides fodder for cattle.

4. If rain falls in December, wheat lands are seldom irrigated, otherwise rarely oftener than twice.

5. Unless the rainy season breaks up late, as was the case this year, the sowings are completed by the end of October in the high lands. Wheat is reaped early in April. I am unable to form an estimate of the crop, as large quantities are imported from the adjoining district of Moradabad. The exportations to Furruckabad, Cawnpore, and Hatras from Bilsie alone, exceed a lac of maunds annually. Large quantities are likewise stored in pits all over the district; it may therefore not be unreasonable to suppose the produce reaches 400,000 maunds, but this is only a guess.

6. A handful of *surson* (Sinapis dichotoma) is thrown on with the wheat, to produce oil for the consumption of the cultivator; occasionally wheat and barley are sown together, and the produce called *bijia*, sold to the poorer classes.

7. The heavy charges attending the transportation of grain to such a distant market as Calcutta, leave little chance of remuneration. Cheap as wheat is now selling, 35 to 36 seers, (of 96 weight,) I question whether it could be landed in Calcutta at more than 20 seers per rupee, bazar weight.

8. Two kinds are sown; the *ruttoa* or white, and *kuttea* or red wheat. The former is most esteemed. Samples of each will be despatched by banghy.

11*th December*, 1843.

Replies from the Bolundshuhur District. By THOMAS TONNOCHY, ESQ.

I have now the pleasure to reply to the Queries contained in your letter of the 15th June last, as follows:—

Replies to 1st Query.—The land on which wheat is grown in this district, and I should say throughout these provinces, may be classed under four heads: the first of which

should, from the circumstance of their productive qualities not being referrible to the agency of man, be denominated natural soils: they are the loamy or rich clay, here termed *daukra;* the sandy or *bhoor,* by which is meant the impure earthy sand, and the one in different degrees intermediate to both, termed *seotah.* These three are again divided into first, the *abee,* that is land accessible to irrigation from wells, rivers, tanks, nullahs or other sources; and secondly, the *baranee,* or land altogether dependent, as its name implies, on the periodical rains, not only for producing a crop, but rendering it fit for ploughing and sowing. The fourth description of land, (which might originally have been any one of the three preceding kinds,) is composed of the artificial soil lying immediately about towns and villages, created by the washings and deposits from such places, and the repeated manurings, which without much trouble, labour, or cost, the owners are enabled to give it, from the filth which accumulates in the vicinity of all dwellings. This land which is called *barah,* and also *dofuslee,* from its producing two crops within the year, possesses of course the highest productive qualities, and it is always accessible to irrigation from wells and tanks, which are amongst the first to be called into existence on the formation of towns and villages; those qualities are generally brought forth to their full extent.

Reply to 2nd Query.—I may at the first state, and that shortly, that the beegah "*kham*" or "*cutcha,*" and which is the only one comprehensible by the generality of cultivators, is the one-sixth of an acre. The beegah, however, which is used on all occasions of transfer and official record, is the five-eighths of an acre; it contains 3025 square yards, and is denominated "*pokhta*" or "*pucka.*"

The rent per beegah varies considerably, being affected by too many causes to admit of their being comprehensively treated in such an article as I can, upon the present occa-

sion, write. One great cause, besides that of diversity of soils, may be referred to the amount of competition existent in different places, and depending on the state of population. Another is the character of the people to whom the land is available, and to habits which are in a very material degree operated on by caste, and the prejudices inseparable from it; for while there are whole communities who would consider it degrading for the female members of their families to aid them in out-door work, there are others whose bent lies so entirely in the way of a purely Agricultural pursuit, in forwarding the means of life, that they fully avail themselves of such assistance, and are consequently enabled to overcome the drawbacks, and escape the numerous taxes to which they would otherwise have been subject. Of this class, are the "*Jats*" and "*Lodhas*," amongst the Hindoos, and "*Jhojhas*," who are Mahomedans.

The distinction between two such communities as the above, is too broad, as not at once to shew the difference between their abilities to pay equal rent for land of the same description, but situated in their several localities. In order, however, to afford some idea of the general rates of rent, which may be taken to prevail in this district, I begin in the first instance to state, that land is subject to three kinds of tax. The first is a fixed "corn rent," but this is far from prevailing in any great degree, and is altogether confined to detached portions of rent-free land, chiefly lying about cities and towns; the rate of this rent is about one "*ukburee*" maund (27 seers of 80 Company's rupees to the seer grain) per beegah *kham* per annum; paid alternately out of the kinds produced in the *khureef* and *rubbee* harvests; from which it will be seen, that its value fluctuates, not only with reference to the difference between the worth of the products of the two harvests, *i. e.*, between wheat on the one hand, and joar, bajra, and mukka (Indian corn) on the other, but to the state of the market; for the rent in

kind, that would bring one rupee when plenty prevailed, would be worth two in a dear season,; so that it will be perceived, that such a description of rent cannot be fixed with reference to any rate in cash.

The second kind of tax is that by which a certain portion of the produce of land belongs of right to the person entitled to buy it, whether under the designation of Proprietor, Zemeendar, Muafeedar, or any other. The proportion so levied varies in different places, being subject to local usages, founded on rights, either heritable or prescriptive, which are enjoyed by the cultivators. With this proviso I may state, that under the system in question, the landlord takes from full one-half to so low as one-fourth of the produce, the intermediate rates being two-fifths and one-third, and his share is levied either by *kun*, *i. e.* estimation of the contents of grain in fields, when the crops having ripened are still standing; or by *butreç*, *i. e.*, actual division of the out-turn in grain, after the processes of cutting, treading, and winnowing have been gone through, but of course before the grain has been at all moved away from the treading ground. No cash value can be fixed for this kind of rent, which it will be clearly seen, is liable to be acted upon not only by the seasons, but the state of the markets.

The third kind of tax is that where the rent is paid in cash; the amount of this is also subject to variation; that is from the local usages above set forth, and the character for industry of the class of cultivators to whom the land is available: but in general the rate per beegah, *pucka* or *pockta*, may be taken to be as fallacious, being what was deduced by me from enquiries which I instituted when about forming the settlement of a portion of this district.

	Description of Land.	Produce.	Qualities of Soil. First.			Second.			Third.			Average of the 3 last Columns.		
For "Abee" or Land accessible to irrigation.	Barra or Dofuslee, ...	Cotton and Tobacco, ...	12	0	..	9	0	..	6	4	..	9	0	0
		Indian Corn and Barley, ...	7	8	..	5	4	..	3	8	..	5	2	8
		Total, ...	19	8	..	14	4	..	9	12	..	14	2	8
	Land lying beyond the Barra, ...	For produce not capable of being subjected to "kun" and butree, such as Indigo, Cotton, Churree, &c. and therefore subject to cash rent,..	4	8	..	3	0	..	2	4	..	3	4	0
		Wheat, ...	6	0	..	4	8	..	3	0	..	4	8	0
		Barley, ...	4	8	..	3	0	..	2	4	..	3	4	0
For "Baranee," or Land not accessible to irrigation.	Khureef Harvest, ...	Bajra, ...	1	8	..	1	2	..	0	12	..	1	2	0
		Moat, ...	1	2	..	0	13	6	0	9	..	0	13	6
		Joar, Oord, Mash, &c., ...	2	4	..	1	11	..	1	2	..	1	11	0
	Rubbee Harvest, ...	Barley, Gram, &c., ...	2	4	..	1	11	..	1	2	..	1	11	0

In closing my reply to the 2d query, I beg to draw your attention to the remarkable difference which the above statement exhibits between the *barra* and *abee* on the one hand, and the *baranee* on the other; and when I state that more than the half of this district lies waste, and that the irrigated land amounts to no more than one-fourth of the cultivated area, I at once shew the drawback it labours under, and the great advantages which the present condition of things afford for Agricultural enterprize combined with capital, for the outlay of which, sufficiently long leases could be secured by speculators to insure a full return. It would be perfectly easy to calculate the area that a certain sum expended in the construction of wells would bring under irrigation, and as practical farming and the location of farms would be productive of manure also, the difference between the *baranee* rates of rent, and the *abee* and *barra*, might well be held in prospect, and confidently reckoned upon as the return to the speculator, for the employment of his capital and labour.

Reply to the 3rd Query.—In endeavouring to form a data for my settlement, I assumed a pucka plough of four bullocks, to be capable of cultivating 120 cutcha beegahs (32 pucka beegahs, or 20 acres) of land; but as this could not be sown with one and the same kind of grain, and its produce would have to be derived from the two great harvests, the *khureef* and *rubbee*, occurring at two different periods of the year, but the preparation of land for which is simultaneously carried on with the first fall of the regular rains, it will be seen, that the expense attending the ploughing of the whole, the manuring, sowing, weeding, irrigating, cutting, treading, &c. could not be divisible upon any particular portion or produce of that land, without such minute noting and attention, as in all probability have never yet obtained in these parts. All that could be done in the way of arriving at any approxi-

mation to the object in view, would be by drawing out an estimate of the cost, produce, and value of the return that would be made by a compact farm of a given magnitude: and even this would be found to convey rather a general idea of eventual results, than the cost of any article of expected produce. I therefore find myself altogether at a loss in answering the first part of the query in question, and with regard to its latter part, the rate of rent has already been stated, and the quantity of seed sown varies with the amount of moisture contained in the soil; but the average may be taken at twelve seers of wheat to the cutcha beegah, or nearly 72 seers to the acre: the seer being equal in weight to 80 Co's. rupees.

Reply to the 4th Query.—This query has been partly answered in the reply to the second query. The number of the irrigations, however, which wheat undergoes, may be taken at five for *barrah*, and four for land lying beyond the *barrah*, and this number becomes reduced by the number of times that it happens to rain while the crop is growing and coming to maturity. The popular opinion is, that every artificial watering will enhance the produce by a maund cutcha (27 seers pucka of 80 Co's. rupees) per beegah cutcha.

Reply to the 5th Query.—The sowings commence about the middle, and continue to the end of November, and the crop is reaped at the end of March and beginning of April.

The extent of the crop varies relatively to the degree in which the land has been manured, and the number of waterings the crop has received. In *barrah* land, good produce may be taken at 42 maunds, (of 80 Co's. rupees to the seer,) or as many bushels per acre; it is certainly known to be much greater. In land not *barrah* but irrigated, the produce averages from 12 to 18 maunds per acre.

Reply to the 6th Query.—The surson oil seed is sown in rows, but widely apart, with wheat. This is taken up long before the wheat, the produce being but a mere trifle—about a maund from an acre. Some descriptions of land are peculiarly adapted for the growth of wheat along with gram or barley, the former is called *guhchunee* and the latter *gojiee.*

Reply to the 7th Query.—I am not prepared to answer this question, not being in a situation to ascertain the freight which the conveyance of wheat down the Jumna and Ganges would really amount to. On this point, the creation of the Ganges canal, which will run the full length of the "Doab," will effect a material revolution, and render inseparable the connection of Calcutta with Upper India, in as much as the canal is to be a navigable one. On the progress of this work, which is going on very tardily at present, it behoves both the Agricultural Society and the Chamber of Commerce to rest their especial attention; contributing as it will towards the enhancement of the objects of both the one and the other, and conferring on each an amount of incalculable benefit. Adequate funds being all that is required for the speedy completion of this great work, it would not be amiss were the two great Societies I have named, to recommend to Government the raising of a loan for that express purpose: a loan that cannot fail to be far more popular than any other that has hitherto been raised; and as its outlay will prove a productive one in the taxes which will be derived both from irrigation and navigation which the canal will afford, the loan will entail no loss whatever on the Government, in the payment of its interest.

With regard to the value which wheat bears, I beg to say, that it is now selling at 42 seers (of 80 Co's. rupees to the seer) for the rupee; and should a couple of rains fall after a due interval, it is expected that it will at harvest time be procurable at a maund and a half for the rupee. In connec-

tion with prices I beg to say, that the dearth of purchasers of produce, of which wheat is the staple in grain, is so great at present, that the Zemeendars are really unable to raise money upon it for the payment of the Government revenue, and this fact in no small degree evinces the absolute necessity of speedily constructing the Ganges canal, by which alone can a constant opening for her products be ensured to Upper India, and the object of the Agricultural Society of furnishing England with food from India, be rendered feasible.

Reply to the 8th Query.—Only two descriptions of wheat, the white and the brown, is grown in this district; samples of these I shall hereafter send. Some persons made a trial of a large grained two-rows kind of wheat brought from Malwa, but it took such a long time to ripen, having been reaped at the end of May, that it was not considered profitable, and therefore given up; besides which, the wheat, however preferable it was found to be for certain modes of cookery, did not make good country bread.

I regret much the negative way in which I have been obliged to respond to your queries, and the little information I have been able to convey on the points contained therein; but my replies as far as they go, will I trust not be found wholly unprofitable, and I shall remain well content, should they contribute in any degree to pave the way for further enquiries in other shapes.

Boolundshuhur, 1st February, 1844.

Replies regarding Wheat Culture in the Nerbudda Valley. Communicated by Colonel J. R. Ouseley.

I have much pleasure in sending the replies to queries contained in your letter of 15th instant.

1st. On black rich alluvial soil. The best soil, the valley of the Nerbudda. No wheat is sowed as a staple in the provinces now under my superintendence, Sumbulpore excepted. There are a few fields of bad black wheat grown in every direction; rice is the staple.

2d. This will require longer explanation, for quality of soil, the period it has been in cultivation, and the neighbourhood of a large market affects it; 1 rupee to 2-8 is the rent for wheat land per beegah. The beegah is of twenty biswas, and is about one English acre, that is, seventy yards square, or 4900 square yards, instead of 4840. About 32 "paillees" (or thirty-five seers of eighty tola weight,) make one English bushel. Each acre would require about one and a quarter bushel of wheat to sow it, but as the land varies, so the quantity of seed is apportioned.

3rd. I must go back to the valley of the Nerbudda for a reply here also, and must take it in the form least open to suspicion, a memorandum of my own, the informants respectable, and having no object in deceiving. This statement, also from long experience, I have ascertained to be correct, and I regret that it is so, for it shews that the industry of the cultivator is over-taxed. A plough is used as the standard, and counted as equal to sowing 4 manees of seed,* if one in which 4 bullocks are used, but the soil is so rich and stiff at the same time, less than 4 in wheat lands are seldom used; 4 manees, or 20 acres of best land, are therefore tilled with one plough, produce 8 fold, giving 32 manees return, harvested and housed. Which if sold at 4 rupees per manee, at harvest time, gives, ... Rs. 128 0 0

This is often regulated by "Bundpore," or a committee of landed proprietors, who vote for a price.

* 1 Manee is 24 kooroos, each kooroo 8 paillies, each paille 90 Co's. rupees weight; therefore a manee weighs about 4 maund and 32 seers, 40 seers a maund, 80 tolas a seer ?

The charges on 128 rupees are seed with "baree," or interest (fifty per cent.) six manees at four rupees,...	Rs.	24	0	0
"Halwah" or ploughman five "manees,"	,,	20	0	0
"Oorya," or sower; feeds the funnel of the plough, half manee, ...	,,	2	0	0
"Churwai," bullock keeper, 2 manees, ...	,,	8	0	0
Bullocks' expenses; feed 4 manees, ...	,,	16	0	0
"Lohar," bullye, burrohie, chamar, nye, "dhobee," sonar, patwary, all village servants, paid in kind, 2 manees, ...	,,	8	0	0
Iron, leather, ropes, &c. cost, ...	,,	4	0	0
Deduct, ...	,,	82	0	0
From 128 rupees, leaves,...	,,	46	0	0
Government rent at Rs. 1-8 per beegah,	,,	30	0	0

Leaves for the cultivator Rs. 16, from which he has to support his family, and pay interest on money and any thing extra, to the Malgoojar.

This is a very high average for wheat lands at 8-fold, but a little "scarce" (khurreef rice, &c.) land is thrown into the bargain in general, and the cultivator contrives to exist; to make an average of khurreef is quite useless, it is so uncertain. The rubbee cultivator, must allow for, "teora" (tares) for his cattle, for chenna, (gram or boot,) moosoor, tillie, ulsie, toor, &c. I have taken the above as wheat altogether, no more can be produced in "bunded," or irrigated lands. If the "kirson" works himself as "halwah," he saves more, but can only manage one plough.

4th. No. No irrigation is used for the best wheat, "jalalia," and "kutya," but in Nursingpoor and Jubulpoor, Bandwas' cultivation is general, that is, the fields are surrounded by high banks, a foot to 3 feet high, which retain the water of the rains. The wheat is however not so good

as in the valley of the Nerbudda, beyond Nursingpoor west, and there no irrigation whatever is requisite.

5th. Wheat sown in October or beginning of November, reaped in February or March. One kind of wheat in Baitool called "sat'ya" or sixty days, is said to be ripe within that period from being sowed. The last part of the question is answerable in the third reply.

6th. Very seldom any instance but in new soil, or very old, "birra" wheat and chenna are sown; this is seldom done, and is by no means profitable.

7th. This is hardly answerable, as it would have to go to Mirzapoor by land carriage, and then down the Ganges; say 8 rupees a manee; add duty in Rewah, &c. 2 rupees=10 rupees, or 2 rupees for a maund of 40 seers of 80 tolahs each.

8th. There are several kinds, and I place them in their order as estimated by the people, prices being given :—

Per manee, or nearly 5 maunds of 40 seers.

1st. Jalalia, say, ...	4	4	0
2d. Kuthen, ...	4	0	0
3d. Sahaliya, ...	3	11	0
4th. Satya, ...	3	8	0
5th. Pissie, ...	3	0	0

Regarding the first, in September 1839, I sent some to Dr. Wallich, who presented it to the Agricultural Society. A Committee pronounced it the best in India. I quote the words of a note of the late Secretary, Dr. Spry: "Some "Hossingabad wheat (Jalalia) which was presented to "the Agricultural and Horticultural Society, of India by "Major Ouseley through Dr. Wallich, and reported on "by a Committee, was pronounced superior to any that the "members had ever before seen in India. It weighed full "sixty pounds to the bushel." You will find the result of the investigation in the Transactions for 1839. I know that in the test of quantity of flour ("soogee") and quality,

colour, and taste of bread, it is superior to any I ever saw any where.

It is a source of much regret to me, to find a country of the nature of the Nerbudda valley so neglected in regard to roads. Fifteen or twenty years ago, a road from Jubulpoor to Mirzapoor was made. This is in excellent order, bridged throughout. I have already recommended the continuation of this line through Hoshungabad, Hurda, Asseergurh, (Boorhunpoor) in Khandeish, to Bombay, and with the finest coal fields in India, or probably the world, (the coal having been tried at Bombay on the *India* steamer, and proved to be 83 per cent. better than the best Scotch coal,) adjacent to inexhaustible iron mines. I see not why the road now made to Mirzapoor should not be converted into a rail road, and the rest of the line continued, as I advise. A few engineers and men from the great iron works in England or Wales alone are wanting, since lime, charcoal stone, water, coal and iron are all to be had at one spot, Benar, near Chichely. Surely the energies of our practical men could not be better employed than to apply those resources to making this superb work. The material the property of the Government, and the country through which the road would pass also, would reduce the cost of the road to one-twentieth what it is in Europe.

The country after ascending the Kuttra Ghaut near Mirzapoor, until nearly Boorhanpoor, a level, and then only one ghaut on the Nassuck road, (already finished,) from near Boorhanpoor to Bombay. The line from Mirzapoor to Calcutta is too well known to need being mentioned ; all is feasible at small expense comparatively, and ultimately great gain must result in removal of produce, the cotton, wheat, sugar, bulky and immovable, would find their way down. Iron for all purposes, coal for the steamers, conveyance of passengers, cheap and rapid relief of troops across the Peninsula, and every purpose to which it is now applied at

home. Great part of the Post Office establishments would no longer be required, and other savings. It is no further in advance of the present state of the country than our other scientific establishments, and no more beyond the means of the Government, than the construction of an ordinary road. But until by the instrumentality of railways, the productions of Central India are transported to the markets of Calcutta or Bombay, it cannot be expected, that the extra qualities will have sufficient inducements for people to pay extra prices, although, like Jalalia wheat, one-third better. This matter deserves to be prominently brought to the notice of the Government.

There are other names for wheat in Central India; for instance, the "doodhia" of Ellichpoor, that approaches nearest to the jalalia. The "moonda" or beardless wheat is also plentiful, and as good as kuttia, No. 2. There are other local names, but they are not for distinct kinds of wheat. Jalalia has the longest beard and straw, and when ripe is a very beautiful, *proper straw* colour. Kutia has a beard, is darker and dirtier looking. Sahaliya is with and without beard, light and agreeable colour. Pissee has a beard, is a coarse, white, bad wheat, by no means nutritious, gives large returns. I shall do myself the pleasure of sending samples as soon as possible.

Chota Nagpore, June 20, 1843.

P.S.—I may as well mention, that on breaking up new land, wheat is not sowed until the 3d year, if good soil, often it is brought under wheat cropping; no alteration of crops takes place, until the soil becomes too weak, in from 10 to 20 years. No manure is given, and no irrigation. The land is ploughed 3 or 4 times in the rains and "bokkered," or harrowed before sowing in October, it then becomes as level as a well raked garden, without hardly any trouble.

Replies from Ellichpore. *By* Dr. W. H. Bradley.

I have much pleasure in offering this trifling information upon the cultivation of wheat in this part of India to your acceptance. It is of no particular interest in itself, but may perhaps serve to guide you in your intended communications, as to its value in this portion of India.

About this neighbourhood, black cotton ground is the one preferred for cultivating wheat.

Rent is paid by the ryot, at the rate of twelve annas a beegah.

The total cost of cultivating a *nathan* of wheat, would be as follows:—

Ploughing, ... Rs.	6	0	0
Harrowing, ...	3	0	0
Seed and sowing, ...	2	0	0
Rent, ...	6	14	0
Total, ...	17	14	0
Value of crop, deducting expense of reaping,	33	0	0
Profit, ...	15	0	2

Wheat is sown here immediately after the monsoons. No other moisture is needed than the heavy dews. When however it is unseasonably sown, twice a week irrigating is considered sufficient, which is continued till the ear swells and arrives at perfection.

The usual time of sowing is early in October, and is reaped early in March. The crops run upon an average about four *kandees* (of 320 seers) to a *nathan*.

It is unmixed with other crops.

Wheat is now selling here at fourteen annas and eight pies a maund for the best sorts.

Three varieties are cultivated in the Berar valley, the *bunsee*, the *cutteah*, and the *poaltiah*. The first of which is the best, and makes the finest flour; the two latter are apt to form heavy and indigestible food.

Samples of each are sent.

Wheat constitutes the staple food of many of the inhabitants of Berar, in some parts of which it is most extensively grown, as around Oomrowtee, Mana, Koorun, and Mootoozapoor. Large supplies of the grain are also admitted from Malwah, Baitaol, Hussinghabad and Rawulpoor.

Ellichpoor, 18*th November* 1843.

Memoranda of the Expense of hand-cleaning Maunds 21,288 *of Doodea and Gungajelly Wheat.*

Description of Wheat.	No. of maunds bought.	No. of maunds of cleaned Wheat produced.	No. of maunds of light Wheat separated.	No. of maunds of dust taken out.	Avrg. of light Wheat per md. on the quantity bought.			Average of dust per maund on the quantity bought.			Total average per maund of light Wheat and dust taken out.		Cost of hand-cleaning per maund.	Cost of other charges per maund.	Total charge per maund.
	Mds.	Mds.	Mds.	Mds.	Mds.	Srs.	Chs.	Mds.	Srs.	Chs.	Srs.	Chs.	Annas.	Pice.	Annas.
Doodea, ...	273	232	25	16	0	3	10½	0	2	5¾	6	0¼	1 11¾	6 4	2 6
Ditto, ...	503	492	11	7	0	0	14	0	0	9¾	1	7¾	2 9	6 0	3 3
Ditto, ...	168	119	25	24	0	5	15½	0	5	12	11	11½	3 0½	6 0	3 6½
Ditto, ...	3,753	3,036	612	105	0	6	8	0	1	2	7	10	2 10	6½ 0	3 4½
Ditto, ...	777	724	42	11	0	2	2½	0	0	9	2	11½	1 4½	4 0	1 8½
Gungajelly,	8,[illegible]	7,974	7,020	173	0	0	5½	0	0	13½	1	3	.. ..	.. ..	.. ..
Ditto, ...	5,912	5,492	325	95	0	2	3	0	0	10¼	2	13¼	1 3¼	4¾ 0	1 8
Ditto, ...	1,683	1,600	41	42	0	1	0	0	1	0	2	0	0 5½	4 0	0 9½
	21,288	19,669	1151,20	473											

Bought Maunds 21,288 of Wheat, gave 19,669 of cleaned Wheat, and 1151·20 maunds light Wheat, Gram, &c.; also 473 maunds of dust and dirt.

Cossip[illegible] Mi[illegible] [illegible]h D[illegible] [illegible]r, 1843.

Memorandum of 48 *Boats of Dhoody Wheat, purchased by* CHARLES SARSON *at Monghyr, in the year* 1840.

60,453 maunds of Dhoody Wheat.

	Rs.	As	Ps.	Rs.	As.	Ps.
Prime cost of ditto, ...				69,039	4	6
Charges on ditto; viz. Boat Hire, Mats, Coolies, Loading, Peons' Wages, Toll, &c. ..	8,349	2	0			
Native Establishment, ...	1,265	15	6			
Petty Charges, ...	61	1	6			
Post Office, ...	21	13	6			
Office Charges, ...	12	5	6			
Law Charges, ...	18	12	6			
Stamps, ...	17	0	0			
Brokerage, ...	258	14	9			
C. Sarson's Commission, ..	2,027	8	0			
				12,032	9	3
Rs.				81,071	13	9

Averaged throughout, including all charges, 1 rupee 5 annas per maund.

The purchases took place between the months of April and December.

C. SARSON.

Calcutta, 6th November, 1843.

Report of the Wheat Committee, on the introduction of Indian Wheat into British Ports, on an equalized duty with the production of Canada.

In entering on a report of the information we have before us respecting the question of the introduction of Indian wheat into British ports, on an equalized duty with the production of Canada, which information is digested in the tabular statement herewith submitted, to which this report may be considered as an appendage, your Committee deem it desirable, with a view to its clearer elucidation, to class the subject under the following heads:—

1st. The information as regards the agricultural view of the question.

2nd. Such as refers to the ratio of production in the several districts.

3rd. The cost of producing, and the profit derivable by the grower and speculator.

4th. The practicability of exporting the wheat when produced.

1st. *Agricultural View.*—The article appears to be produced generally on two descriptions of soil, the stiff clayey tracts of high land never inundated, and the light sandy alluvions that are changing every year; but we have not any means before us of testing the relative value of each for the growth of wheat, or the relative extent of each available to this object. The time best adapted for sowing wheat in all parts of the country appears to be the month of October, being the period when the lands are recovering from that excess of moisture consequent upon the periodical rains. In the course of its growth on the higher lands, it would appear to require irrigation, so as to keep up a supply of moisture not naturally to be found in the soil; but an opinion prevails that the more irrigation is resorted to, the less valuable in quality is the produce, and that wheats deriving their

sustenance only from the natural moisture of the soil, are superior in quality to those assisted by irrigation. It remains, however, yet to be proved, whether this difference arises from the act of irrigation, or is traceable to the component parts of the soils themselves, the irrigated crops being those on high clayey lands, and the non-irrigated ones being alluvion. The period of reaping too is the same in the several parts of the country from whence we have returns, ranging between February and April, according as the crop is forward or otherwise. A great error in the cultivation of this article prevails all over this country in the admixture of other crops with wheat;* but this being the case with almost every other articles of culture by the natives, it would be exceedingly difficult to effect a reform, and could, in all probability, only be accomplished gradually by the purchasers for export, steadily rejecting such wheat as was at all mixed with other grain.

It is unnecessary in this report to comment on the mode of Agriculture in this country, or to point out the improvements that might be made in it; suffice it to say, that great benefit would accrue to native Agriculture at large from improving the rotation of crops, and that we may fairly hope to see a great extension of cultivation of wheat as soon as we have a wide market open to it. Some of the finest wheat countries are to be found in the vicinity of our Calcutta market; but beyond Behar, the distance would appear to be too great to allow of a profitable import at the present high rates of transport. Besides this consideration, it may be observed, that the places beyond that province are wheat-consuming districts, and the residents have consequently less reason or desire to transmit it to another market. It appears therefore probable, that the chief export to Great Britain must be from the eastward and southward of Patna.

* An exception is to be made in the case of the Saugor and Nerbudda territories, where, as we learn from the report of Colonel Ouseley, other crops are very seldom sown with wheat.

2nd. Ratio of Production.—Coming to the second point, or that which refers to the ratio of production, we find, on reducing the measurement to one uniform standard, the Bengal beegah of 14,400 square feet, that the general average in the tabular statement ranges from 6 to 7½ maunds per beegah. It has been proved, however, from the returns received by your Committee, that this may be greatly enhanced.

3rd. Cost of producing and profit derivable.—The next division of the subject brings us to the consideration of the profit to be derived from the culture as a speculation. The cost of cultivation would seem to decrease in proportion as the article is grown nearer to Calcutta; for we find that about Bhauglepore, Goruckpore, &c. the outlay would be from rupees 2 to rupees 5 per Bengal beegah, whereas at Benares, Allahabad and Lucknow, it increases from rupees 8 to rupees 14; thus at once shewing the advantages possessed by the lower parts of the country, and which appear to place the higher provinces, in a great measure, out of the field of competition at present, without reference to the enhanced cost of carriage, in itself a very serious tax on the article. This is more clearly displayed in the column, which shews the rate at which good wheat can be landed in Calcutta per maund. This, from the nearer districts would be, as appears by the statement, from rupee 1 to rupee 1-12, the average being rupee 1 : 5 : 6,* which, at the average of a year made out by Mr. Speede, in his memorandum submitted to your Committee, at rupees 1 : 13 : 4, the selling price in Calcutta, would yield, before shipment, to the grower, or mofussil dealer, a profit of thirty-seven per cent. It is unnecessary, in this place, to point out how much this profit would be enhanced to the party making

* Mr. Sarson's memorandum, founded on the purchase of upwards of 60,000 maunds of *doody* wheat at Monghyr, shews the average price, including all charges, to be 1 rupee 5 annas per maund.

purchases for shipment in the Mofussil, for it has already been dwelt on, at some length, in the minutes submitted to your Committee, which minutes, together with other useful papers bearing on this important question, the Society will doubtless transfer to its Committee of Papers for publication in its Journal. The returns from the higher provinces shew a range of from rupee 1 : 10 to rupees 2 : 12 per maund as the price of landing good wheat in Calcutta, the average being rupees 2 : 1 : 3, shewing an excess on the Calcutta rate before stated, *i. e.* rupee 1 : 13 : 4, of 3 annas and 11 pie, or a loss of more than twelve per cent. Thus, without taking into consideration the fact of the residents of the higher provinces being themselves large wheat consumers, we can hardly expect perhaps for some time to come, that much wheat will be drawn from that portion of the Indian empire, for export to Great Britain.

4th. Practicability of exporting Wheat in good condition.—We now come to the last point of our question, the practicability of exporting wheat when produced. To say nothing of the extent to which the export of flour may be carried, in which form much has been exported, and much more, it is believed, would be sent to Great Britain, were sufficient encouragement afforded; experiment has shewn the fallacy of the assertion, that *wheat* cannot reach England from hence in good condition. It is true, we have a great enemy to our wheats in the weevil (calandra granaria;) but this insect is chiefly found in granaries, when the grain is in store, and where, under the present *mahajunnee* system of purchase, it remains for two or three years before it is presented to the market. These *golas*, or store-houses, it may be observed, are seldom cleaned after the abstraction of the old stock, and the new stock is frequently stored without a previous exposure of the grain, whereby the wheat is not sufficiently hardened to resist even the ordinary attacks of the insect. We have, however, proof, that wheat, *properly*

cured, has lasted, under much exposure, for upwards of eighteen months; that it has been sent to England and returned to this country in good condition; and has obtained a remunerative price, and borne a fair comparison with British and other European produce. With this evidence before us, we cannot but express a decided opinion, that whenever the export has failed, the failure must have been either in the selection, in taking old and infected wheat, or in the curing, or in want of sufficient care and attention in the storing.* Hence, as is too often the case, the article has been blamed for the faults of those who speculate in it, without fully understanding the requisites for its export.

In conclusion, your Committee, with some confidence, place this short report, and its accompanying statement, in the hands of the Society. The result of your Committee's investigation has been to satisfy them, that this country is able to grow wheat that would find a ready sale in the home market, and that it can be produced and exported at such cost as would yield a very liberal return for the capital employed. They look upon the establishment of an export trade from India in corn as pregnant with advantages to this country, and therefore take the opportunity of reiterating the recommendation contained in their last report; viz. that the Society will be pleased to nominate a Committee for the purpose of preparing petitions to the two Houses of Parliament, praying the admission, into the ports of Great Britain, of wheats from this country, on the same terms as have already been conceded to wheat from Canada, and that copies of the petition be forwarded to the Board of Control and the Court of Directors.

(Signed) JAMAS HUME, G. T. FRED. SPEEDE,
C. R. PRINSEP, JOSEPH WILLIS.
WM. STORM,

* See Mr. Wood's letter appended to this Report.

Extract of a Letter from James A. Wood, Esq. *Superintendent of the Strand Mills, dated 12th February,* 1844.

With regard to the practicability of sending wheat from this to England, to arrive there in a good sound merchantable condition, I have not the slightest hesitation in saying, that it can be effected by proper attention being paid, in the first instance, to cleaning, packing, and shipping. I speak from practical experience. Before my arrival in this country from Sydney, I was in the habit of receiving large quantities of wheat from Calcutta, and grinding it: I have known it after a passage of 72 days, and being four months stowed in a godown, to be quite free from weevil or fly; and, on the contrary, I have known it to arrive at the same time nearly destroyed by weevil. The reason is clear. The grain that arrived in good condition was always quite clean on arrival in Sydney, and had evidently been well cleaned in Calcutta, before shipping; on the other hand, the grain that arrived in bad condition, was invariably of the foulest condition when received, though it was the same quality of wheat; viz. the *Doodea,* and could not have been cleaned before shipping from Calcutta.

The above, I should think, would be quite sufficient to guide the Society in forming an opinion, that wheat, with due care and attention in cleaning, packing, and shipping, can be shipped to England or any other country, to the greatest extent, in the best condition possible.

I intended submitting to the Society, a sample of wheat, that had been a voyage to England and back again; but unfortunately it has been mislaid by a party to whom I had sent it for inspection.

To the Right Honorable the Lords Spiritual and Temporal of the United Kingdom of Great Britain and Ireland, in Parliament assembled.

The humble Petition of the Agricultural and Horticultural Society of India.

RESPECTFULLY SHEWETH,

That your Petitioners are members of a Society, which has for upwards of twenty years past existed in Calcutta, under the name of the "Agricultural and Horticultural Society of India," having for its object the promotion and improvement of Agriculture and Horticulture.

That the attention of your Petitioners has been lately directed to the cultivation of wheat in India. That with a view to obtain good practical information on the mode pursued in the culture of this article, on the ratio of production, on the cost of producing and profit derivable, and on the practicability of exporting it in good condition; your Petitioners addressed themselves during the past year to Agriculturists and other residents in various districts of Bengal, and the North-Western provinces, as also to parties engaged in the trade in Calcutta. That the result of such enquiries has been to satisfy your Petitioners, that this country is able to grow and export wheat that would find a ready sale in the home market at remunerating prices, were sufficient encouragement afforded. Your Petitioners conceive it unnecessary in this place to occupy the time of your Right Honorable House, with any lengthy remarks in regard to the culture, &c. of wheat in India; but they would respectfully beg reference, for such details, to the report of your Petitioners' Committee, which accompanies this petition, and whereon is based the opinion formed by your Petitioners of the certain advantage the opening of such a trade would afford, not only to Indian commerce, but

also to that of Great Britain, in the necessary return of her manufactures.

While, however, your Petitioners are fully satisfied that the capabilities of India, as a wheat-growing country, are very great, and that any quantity of corn could be exported to meet the daily increasing demands of the mother-country, they would respectfully beg to draw the attention of your Right Honorable House to the serious drawback to such export, which now exists, in the duty levied on this necessary article of food.

Your Petitioners are aware of the passing, during the last year, of the Canada wheat and flour bill into a law, and the consequent advantages now possessed by that colony. Actuated therefore by a desire to further the objects of their Society, and to assist not only in ameliorating the condition of the agricultural, laboring, and all other classes of India, but in a no less degree that of the mother-country, your Petitioners respectfully pray, that your Right Honorable House will be pleased to take into its earliest consideration, the justice and expediency of allowing the admission, into the ports of Great Britain, of wheat from this country, on the same terms as have already been conceded to wheat from Canada.

And your Petitioners, &c.

[The Earl of Auckland, has been requested to present the Petition to the House of Lords, and that to the House of Commons, has been entrusted to Joseph Hume, Esq.]

Memorandum of the method of collecting Opium from the capsule of the Poppy, as practised in Assam. By John Owen, *Esq.*

To the Secretary of the Agri-Horticultural Society.

Dear Sir,—The subject of opium has for late years attracted much attention amongst the moralists and commercial classes in Great Britain; much has been said of the immorality of its use, its destructive effects on the people using it, and the necessity of a Christian Government interfering to prevent its extension, and to discourage such a cultivation. I am not going to enter upon a discussion of these points of the question, nor to argue the propriety or otherwise of prohibiting its production; or of opposing its use, whilst that of malt, and other articles, the pabula of distilled and intoxicating liquors, are encouraged, but it may not be uninteresting to those connected with the Society, to refer to the mode of collecting the juice of the opium plant in Assam.

I have no data on which to ground any statistical remarks as to the extent of culture existing in that country, or the proportion it bears to other articles of agricultural produce. Its growth is necessarily limited, because though no prohibition exists respecting it, it is, as far as possible, discountenanced by the local authorities in the province ; in some measure also by the continued impoverished circumstances of the people themselves, few having been, until very recently, able to afford this luxury of their ancestors, save in very moderate extent. On the part of the Government authorities, under the suggestions of Major Francis Jenkins, the Commissioner, whose exertions and good intentions towards the people under his rule are so well known, an undoubted preference in point of encouragement has been given to the article of tobacco, in the supposition, that this is less generally demoralizing in its effects, a point however upon which I do not offer an

opinion; but it is generally acknowledged, that the natives in that quarter have arrived at the point of considering opium rather as a necessary, than a luxury of life; and I strongly suspect, much difficulty would be experienced in any endeavours at inducing them to leave off its use, more particularly when we take into consideration the increased amount of the circulating medium that has lately been introduced by the Assam Tea Company, and other speculators into that province. Formerly, labourers could not command more than from 1 rupee 8 annas to 2-8 per mensem; now they freely receive from 4 to 4-8. It is unnecessary to point out the vast amount that such a difference places at their disposal, for the cultivation of this or other articles of improved production; and such is the character of the people, that in nine cases out of ten, they would expend the whole amount of this difference in the culture of opium, and for this purpose deny themselves every other pleasure or luxury, nay, even the necessities of life. Nor is this feeling confined to the male population only, the women being equally disposed to indulge both in smoking, and otherwise using it.

The course of cultivation of the plant differs little from that pursued in other parts of India, and when the capsule of the poppy approaches maturity, irregular incisions are made on them with the *katari*, or one-bladed knife, in which respect a marked difference exists between the Assamese, the Behar, and other methods of obtaining the juice. A *scarifier* of six to eight double pointed blades used horizontally, being the usual mode there adopted for bleeding the capsule, whence the exuded juice is, after twelve hours, collected in a sort of small trowel, in which respect there is a marked difference in the Assam system, under which the exuded matter is collected on strips of cloth, which when perfectly saturated, are rolled into balls, and thus sent to market.

I am not aware whether the opium so collected has ever been submitted to a chemical test, so as to fix in any manner the difference of value between this and the Government opium. In the form I have described, it is called by the Assamese *káni*, and when new, and consequently less in demand, may be obtained from ten to twelve rupees a seer; though in a scarce period of the season, selling from forty-five to sixty-four rupees per seer. It is notorious, that the *Kyahs* or *Marwarrees*, who have for some years monopolized the external trade, make an handsome annual income by their opium speculation, extending their village advances after the plant has germinated, and then valuing the crop, which on coming to maturity, becomes the property of the so-called purchaser or mortgagee.

In use, it is considered that a piece of the cloth from five to six inches square, infused in water, is one dose, of which from five to six doses are daily taken by those who indulge in it, the cloth being afterwards used in chewing or introduction by the nostrils, and not unusually in their infatuation for the drug, placing it in the orifices of the lobes of their ears. In preparing it for inhalation, some *támul pât* or betel leaves are boiled, dried, and mixed with the opium, the composition being afterwards made into small balls and placed in the *chillum*, a few whiffs of which throw the inhaler in a short time into a state of delightful insensibility, of the pleasure whereof every opium smoker speaks with the highest gratification.

Taken to excess, this drug is no doubt debilitating, and injurious to a degree, whilst its moderate use can have little effect on the system compared with any immoderate indulgence of spiritous liquors; but this is for moralists, not for travellers to speculate on. Whilst the duty on consumption usually levied on it in Assam, in common with other articles of production, is of some value to the Government; legiti-

mate, as affecting an object of luxury and indulgence, in common with all excise imposts.

If the foregoing be of any use to the Society, or others, it is at your service.

THE JOURNAL

OF THE

Agricultural & Horticultural Society

OF

INDIA.

No. XII.—1843.—Vol. II.

Report on the cultivation and manufacture of Tea in Kemaon. By William Jameson, Esq. *Superintendent Botanical Gardens, North-Western Provinces.*

To James Hume, *Esq. Secretary to the Agricultural and Horticultural Society, Calcutta.*

General Department, North-Western Provinces.

Sir,—I am directed by the Honorable the Lieutenant-Governor, North-Western Provinces, to transmit to you the accompanying copy of a report from Dr. Jameson, regarding the cultivation and manufacture of tea in Kemaon, with a view to its publication in the Transactions of the Agricultural and Horticultural Society in Calcutta, if it is considered to be possessed of sufficient interest.

I have, &c.

J. Thornton,

Secretary to Government, North-Western Provinces.

Agra, 27th March, 1844.

1. The nurseries of Kemaon, as the Honorable the Lieutenant-Governor is aware, are situated in the districts of Bheemtal, Now Chourcheetal, Almorah, and Hawaulbaugh. In the 1st is the nursery of Bhurtpore; 2nd, Russeeah; 3rd, Kupeena and Lutchmesir; and 4th, Hawaulbaugh. The following will shew the quantity of ground occupied by each :—

District.	*Names of Nurseries.*	*Acres of Land.*
Bheemtal, ...	Bhurtpore, ...	2 Acres.
Now Chourcheetal,...	Russeeah, ...	27 ditto.
Almorah,..............	Kupeena, ... 4 Luchmesir, ... 6	... 10 ditto.
Hawaulbaugh, ...	Hawaulbaugh, ...	16 ditto.

2. The Hawaulbaugh nursery was established during the last rainy season. In these nurseries, we have the following number of plants :—

Name of Nurseries.	Number of Tea-bearing plants.	No. of plants which will bear Tea in the ensuing season.	Number of Tea plants transported in 1843.	Number of seedlings ready for transporting.	Number of layers ready for removal.
Bhurtpore,	1,460	,,	1,201	8,171	500
Russeeah,	,,	17,000	1,000	37,000	,,
Lutchmesir,	1,546	,,	4,500	34,120	400
Kupeena,	1,300	,,	5,500	17,000	,,
Hawaulbaugh,	,,	10,000	,,	,,	,,
Total,	4,306	27,000	12 201	96,291	900

3. From the above table it appears, that the increase of young tea seedling plants during the last season has been 1,12,392, or equal to four times the number reared since the nurseries were first established in 1835-36. Of these,

however, 12,201 have been already planted out in different nurseries, leaving 97,191 for transplanting. These, giving five feet to each plant, will cover about 56 acres of land. In compliance with the permission granted to me by Government, I marked out a new nursery of 35 acres (*kova-kesar*) in the neighbourhood of Bheemtal, the land having been made over to me for the purpose by the Commissioner, from whom and his assistant I beg to remark, that I have received every assistance. A second, of 20 acres, in the neighbourhood of Hawaulbaugh. As Mr. Batten was about to make a new settlement of the land in the neighbourhood of Russeah, I requested him to set aside ten acres in addition to those already covered with tea. Here too in the neighbourhood of the Tal of Now Courchee, there is much land admirably adapted for extending the nursery when plants for the purpose are ready. I have also added about an acre to the Kupeena nursery.

4. In selecting land for the new nurseries, I have paid due consideration to the geological structure of the districts, soil, locality, &c., and have selected places similar to those that are considered good localities in China for the Tea plant. The geological structure of the Kemaon province is highly interesting. At the foot of the hills we first meet with the saliferous system, consisting of red and green marl, sandstone, bituminous marl slate, imbedded in the marl; enormous beds of gypsum or sulphate of lime occur, highly valuable in the arts, and which might be obtained here in any quantity, and a bituminous slate clay, which abounds with alum or sulphate of alumina. This rock is of high importance, as from it a vast deal of the alum of commerce is procured. At Kalabaugh, on the banks of the Indus, there are 14 manufactories, with from 12 to 18 men in each, engaged in making alum from it: when made, the alum is sold at the manufactory for about Rs. 19 per camel load. It is therefore well worthy of the attention of Government, as the alum slate

occurs in inexhaustible beds, in Kemaon. The saliferous system rests upon a series of clay slates belonging to the transition series; the magnesian limestone, carboniferous and old red sandstone series, being entirely wanting. In several localities, but particularly in the neighbourhood of Bheemtal, greenstone is found bursting through and altering the Neptunean strata. From this locality, on to about three miles of Almora to the Neptunean rocks, consists of alternations of clay slate and mica slates, with enormous beds of quartz rock, all highly inclined, and dipping at angles varying from 25° to 70° to the east of north. About three miles distance from Almorah, we meet with granite, which here forms mountains of considerable elevation. On passing the granite, we again meet with clay and mica slates, with imbedded quartz rock, which form the whole neighbourhood of Almorah and Hawaulbaugh. Such is a rapid and general view of the geology of that province as far as Hawaulbaugh. We shall take another opportunity of giving a more detailed account.

5. From this general view, however, it will be perceived, that we have in the tea districts in Kemaon, a geological structure similar to what exists in the best tea districts in China. The soil too as there, is generally light, and of a silico-aluminous nature, and abounding with mica, which originates from the decomposition of clay and mica slates in which it is met.

6. The following table will give at one view the quantity of land being, and about to be, brought into cultivation with tea plants:—

Name of Nurseries.	*Acres of Land.*
Kova-ke-sar, ...	35 acres.
Russeeah, ...	10 ditto.
Kupeena, ...	1 ditto.
Hawaulbaugh, ...	20 ditto.

7. To bring the above land into cultivation, it will be necessary to make a considerable increase in the establishment of malees. The old establishment was as follows:—

Name of Nurseries.	*Chuprassees.*	*Mallees.*
Russeeah,	1	17
Bhurtpore,	0	3
Kupeena,	0	3
Lutchmesir,	0	3

8. But there being no responsible person always present, the distance intervening between the different districts (35 miles) rendering it impossible for the overseer to be so, I appointed a chowdry to each nursery, and reduced the number of hill mallees. Their excellent and thriving condition point out the beneficial results of this plan.

9. The following establishment, which has been formed with the utmost economy consistent with efficiency, I beg to recommend for the nurseries:—

		Rs.	*As.*	*P.*			
Bhurtpore,	1 Chowdry,	8	0	0			
	2 Mallees, at Rs. 4,	8	0	0			
					16	0	0
Kova-ke-sar,	1 Chowdry,	8	0	0			
	1 Assistant Chowdry,	7	0	0			
	17 Mallees, at Rs. 4,	68	0	0			
					83	0	0
Russeeah,	1 Chowdry,	12	0	0			
	17 Mallees, at Rs. 4,	68	0	0			
					80	0	0
Kupeena,	1 Chowdry,	8	0	0			
Lutchmesir,	3 Mallees, at Rs. 4,	12	0	0			
	3 Ditto ditto, Rs. 4,	12	0	0			
					32	0	0
Chullar,	1 Chowdry,	8	0	0			
	7 Mallees, at Rs. 4,	28	0	0			
					36	0	0
Total,				Rs.	247	0	0

10. I have considered it necessary to recommend an assistant chowdry to Kova-ke-sar nursery from its extent, and the necessity of having the land brought into cultivation as soon as possible. As a temporary arrangement, I have employed 20 mallees in the Kova-ke-sar nursery, since 5th January 1844, and 8 in the nursery at Hawalbaugh, so that a considerable quantity of land might be ready to receive the young tea plants in March.

11. *Gathering of Tea Leaves.*—The tea leaves are gathered by the mallees of the establishment under the direction of the China-men. The seasons for doing so and making tea are April, June, July, September, and October, which may be styled the spring, rainy (summer,) and autumn crops: much the largest quantity was collected in the rainy season, seeing that of the 190 lbs. of tea manufactured during the year, 141 lbs. were then made.

12. The following table exhibits the quantity of tea manufactured during the last year, and the nurseries that afforded the leaves:—

Date.	Name of the Nurseries.	Coarse Tea.		Fine Tea.		Total.		Grand Total.	
		Po		Pound	Ounce	Pound		Pound	Ou
1843.									
April, ...	Lutchmesir,	1	8	20	·	22			
Do.	Bhurtpore,	,,	8	8	,,	8			
Do.	Kupeena,	,,	8	7	,,	7	8	38	,,
June, July,	Lutchmesir	9	12	35	8	45	4		
Do. Do.	Kupeena,	6	8	15	,,	21	8		
Do. Do.	Bhurtpore,	7	8	15	,,	23	,,		
Do. Do.	Russeeah,	2	8	7	,,	9	8	99	4
Sept. Oct.	Lutchmesir.	6	13	21	6½	28	3½		
Do. Do.	Russeeah,	1	10	7	4	8	14		
Do. Do.	Kupeena,	2	2	6	2	8			
Do. Do.	Bhurtpore,	1	2	7	5½	8	7½	53	13½
	Total, ...	,,	,,	,,	,,	,,	,,	191	1½

13. The number of tea-bearing plants amounted last year to 4366. In the ensuing season, nearly the whole of the plants in the Russeea, and a great number of those in the Hawaulbaugh nurseries will also afford leaves.

14. In the space of a few days, the tea manufactured will be transmitted to the Secretary to the Government of Bengal, with the invoice, in compliance with the orders contained in Mr. Secretary Hamilton's letter No. 965, dated 30th August last. The delay of doing so has been owing to the want of the tea canisters, which were indented for in October 1842, but which only reached Almorah in January last.

15. I beg to draw the attention of the Honorable the Lieutenant Governor to the want of implements for manufacturing green tea. It is now nearly 18 months since I transmitted my first indent. I again transmitted another on the 7th December last. The Assam Tea Company have but one set, it will therefore be necessary to procure them from China. That the implements could be made at Almorah, provided that patterns could be procured, is no doubt probable, though the Chinamen maintain that they could not, as all the baskets, &c. required in the manufacture of black tea are now there made by the establishment, regarding which, they also made a similar statement. At Almorah or in the Upper Provinces, the cast metal pans are not procurable. It will be much to be regretted if another season is allowed to pass, without ascertaining the value of the tea plant leaf for manufacturing green tea. I also respectfully beg to draw the attention of the Honorable the Lieutenant Governor to the absolute want of a tea-chest-maker. Such a person could possibly be procured in Calcutta, or if not, in Canton. If, however, in the former, a first rate person could not be procured, it would be desirable at once to obtain one from the latter. In England almost as much attention is paid to the manner in which the tea is packed as to its quality; moreover, if this is not properly done, its flavour is apt to

be deteriorated. Under these circumstances it is absolutely necessary, that a case-maker be appended to the establishment. If this should meet with the approval of the Honorable the Lieutenant Governor, I shall make the necessary enquiries.

16. *Manufactory.*—The building ordered* to be repaired at Hawalbaugh, for the purpose of a manufactory, will be ready in the course of next month. As soon as the new implements reach Kemaon, it would be most desirable to erect a second manufactory in the neighbourhood of Bheemtal, as the distance to which the leaves have to be carried (35 miles) to the Hawalbaugh manufactory, has a prejudicial effect on them. At Bheemtal, there is an old thannah, which I am informed by Mr. Batten, could be procured for this purpose, and which at a small expense, could be thus converted. After all the leaves in the Almorah and Hawaulbaugh nurseries were manufactured,.the Chinamen could then proceed to Bheemtal, and manufacture those procured from the nurseries in that district. During this last season, the leaves procured in the Bheemtal, &c. district, were transported in baskets during the cool of the evening to Hawalbaugh, but still they always arrived in a more or less dried-up state, which proved not only detrimental, according to the Chinamen, to superior tea-making, but also many of the upper leaves were obliged to be separated and destroyed, which, had there been a manufactory in the district, might have been converted into a good marketable tea; moreover, in the space of a few years the Bheemtal district will yield a vast quantity of leaves, the expense of the carriage of which alone to Hawalbaugh would soon cover the present proposed and necessary outlay.

17. *Future prospect of the tea plant cultivation.* The experiment as far as it has been tried, has fully realized

* See Government letter, No. 1014, dated 9th September, 1843.

the most sanguine expectations. On the authority of the Chamber of Commerce of Calcutta, the tea has been pronounced "a very good marketable article,"* and by Messrs. Thomson and Son of London, † "as fine flavored and strong, and equal to the superior black tea sent as presents, and better for the most part than the China tea imported for mercantile purposes."‡ With statements from such authorities, the experiment may be considered as fully tested, and now steps ought to be taken to bring it to profitable account. There are vast tracts both in the provinces of Kemaon and Gurhwahl, equally well adapted for the growth and culture of the tea plant, as those where it is now thriving. When once Government have sufficient land under cultivation to cover the expense of the outlay, then it would be desirable to induce the natives of the provinces themselves to cultivate the plant, and by them the leaves to be supplied at a certain valuation to the Government manufactories. At present, it must be admitted that in Kemaon the tea experiment is looked upon as a most unprofitable scheme, as there has been a considerable outlay, without any adequate return. From, however, the small quantity of land under cultivation, none could be expected. But the time is now come to consider it no longer in the light of an experiment, and to extend vigorously the culture of the plant, and when it is once proved to the native community that the plant can be cultivated with profit to themselves as well as to Government,

* See Government letter, No. 17, dated 31st May, 1843.

† See Mr. Secretary Hamilton's letter, No. 897, dated 16th August, 1843, with enclosures.

‡ Mr. Commissioner Lushington sent a small quantity of the tea across the British Frontier to the authorities in Thibet; by them it was declared to be of a superior quality, and many enquiries made as to the locality of the plant where the tea was made, &c. and a request, that no more be sent in that direction. Tea is imported packed in skins across the Frontier to Almorah. I have transmitted a packet for the Honorable the Lieutenant Governor's inspection, who probably may consider it worthy of being sent to the Honorable the Court of Directors, in order to be compared with that made in the British province, and to shew how superior the latter is, and how easily it might supplant it in the market. The packet weighing about 5½ pounds, is sold in the Almorah bazar at 5 Rs.

then will they pay attention to it; as an example to the point we may mention the potatoe, which a few years ago was unknown in this country, and introduced at first with but little success, and cultivated in small patches. Natives however having seen the advantages to be derived by its cultivation, have now thousands of acres in culture both in the hills and plains. In China, the tea-plant growers are different classes from the tea manufacturers. So in this country the system may be established. The plant is most hardy and does not require much care in cultivation, there is therefore no cause to prevent it producing some day as much effect in the revenue of the state as the poppy. This assertion is not made rashly. I have examined a large portion of the provinces of Kemaon and Gurhwahl. I have there seen large tracts, many of them lying waste, and admirably adapted for the tea plant. The country in many places is no doubt thinly populated, and this is frequently stated as an objection to the extensive cultivation of the tea. It however is a most erroneous one. Let permanent labour be but once ensured, then will there be no want of labourers. Thus for some time much difficulty was experienced at the new settlement of Mynutal in erecting buildings for want of labourers. Coolies however on finding that they could get constant employment there, have now assembled to the number of 400 or 500, and these, too, principally from the province of Gurhwahl. In order, however, that the increase of the nurseries may be adequate with the demand, it would be most desirable to introduce from time to time, tea seeds from China in quantity, and probably the Hong Kong authorities would now find but few obstacles presented in procuring them. I would therefore beg particularly to bring this to the notice of the Honorable the Lieutenant Governor. The Government nurseries now yield a vast quantity of seeds. The plants now amount to 1,50,000, and these will be doubled I trust, or trebled annually; and were there only seeds

in sufficient numbers, as they germinate most freely, provided that they are fresh, the aspect of the nurseries in an infinitely short space of time would be changed; for instead of patches, there would soon be districts covered with tea plants. Nor are the other methods of propagating the plants by layers, cuttings, &c. neglected. Every exertion will be made to do so on the most extensive scale, and I trust at the end of the ensuing rains to be able to add a considerable tract in addition to those already mentioned. Nor is the state of the tea plant in Gurhwahl less promising. The nursery at Paoree, established last season, contains about 2500 plants in a thriving condition. The nursery at Koolagir in the Dehra Dhoon, contains about 4500, and here the plant is thriving as well as in any of the other nurseries. I have added two acres to this nursery, and beg to recommend that another mallie on 5 rupees per mensem be appointed. It is, however, to be proved whether the leaves yielded by the plants in this locality are fitted for making tea of a superior quality, as it has been ascertained that all the tea grown in China at low elevations is of an inferior description. If, however, it does prove to be a marketable article, and equal to that produced in the neighbourhood of Canton, a vast field for enterprise will be opened up, whether Government considered it worthy of their own attention, or it be brought about by private capital. Water carriage will soon, it is hoped, be within two or three marches of this valley, which will also be a strong inducement, in addition to the above, to make capitalists invest their capital in this channel, and thus we trust ere long to see the hill provinces, which at present yield but a trifling sum to the revenues of the state, become as important in an economical point of view, as any of those in the plains of Hindoostan.

(Signed) WILLIAM JAMESON,
Superintendent Botanical Gardens, North-Western Provinces.

Office of the Superintendent Botanical Gardens, North-Western Provinces, Saharunpore, 28th February, 1844.

Hints on the managment of Tulips, Ranunculuses, Anemones, &c. *By Mr.* H. Groom.

It having been mentioned to me by Dr. Royle, that a few hints on the management of Florists' flowers would be acceptable, I have enclosed the following remarks on the cultivation of the bulbs sent by me this season.

In giving these directions, it must be borne in mind that I am comparatively unacquainted with the climate and best periods for growing flowers in India, it will therefore be necessary to vary the plan according to circumstances.

Tulips.—The best soil for these bulbs, is a light sandy loam moderately rich, with rather a low or at all events a level situation, and were there is a moderate quantity of moisture in the soil; and as these plants grow in England during the winter and spring months, I should consider the best period to plant them would be just before the rainy season, in a cool situation, and if possible shaded from the midday sun. The position having been selected, a bed should be formed four feet wide and of sufficient length for the number of bulbs, the soil of which should be taken out 2 feet deep and broken up fine and a little well rotted manure may be mixed with it, turning it two or three times over to expose the whole to the action of the air; the bottom of the bed should also be dug up rough, and about 2 inches of well rotted manure may then be put into the bed and broken in with the soil. After this is completed, the soil which was taken out may be put into the bed and left to settle for a few days, (of course the preparation of the bed should be all completed before the period for planting,) it will also be better to have a sufficient quantity of very light mould mixed with $\frac{1}{3}$ of fine sand, ready for covering the bulbs; if the sand is from the sea shore, or river, where it is likely to be salt, it should be washed, otherwise the salt will kill the plants.

On the day fixed for planting the bulbs, the mould in the bed should be levelled and raked smooth, it will then be ne-

cessary to mark the positions for the roots, as they will have to be planted on the surface, and afterwards to be covered with the sandy soil.* The best way to mark the positions is to divide the 4 feet bed across at each end into 8 equal parts, by which there will be 7 places for the long rows; if a line is then strained tight on the bed from one end to the other over these places, by springing this line a mark will be made the length of the bed, this repeated to each division, will give the 7 lines, the number of roots to be planted across the bed, the lines crossing these are marked by dividing the bed on each side into intervals of six inches, and then by drawing a line across you have the figure, No. 1, in the plate annexed.

A root is then to be placed where the lines cross each other, and when the planting is finished, they are to be covered with the sand and soil $3\frac{1}{2}$ inches deep, and the bed raked level. They do not require any further attention until they have grown 5 or 6 inches above the ground, when they may be watered occasionally if the weather is very dry or they appear to require moisture; when they begin to shew their flowers and get into colour they should be protected from the sun and heat as much as possible, at the same time giving all the light and air that can be managed. In England we shade the tulips when in bloom with canvass on a large frame called a tulip stage; mine is 14 feet wide 150 feet long 7 feet 6 inches high to the top of the posts, and 12 feet 6 inches to the under edge of the ridge board, giving the figure No. 2.

The cloths which cover the top are made so that they can be drawn up when the sun is not shining, and at night to give air which is necessary to keep the plants from drooping. I should think for India if the sides were made of wire work or some good conducting material (coarsely perforated zinc would do) with iron supports here and there driven into the ground, it would allow the air to pass through it and at the same time the air would be deprived of a considerable portion of its heat by the metal which would convey it into the earth.

I think the same plan might be desirable to cool your dwellings in hot weather, particularly if there was an external frame on which coarse cloth was strained and the cloth kept constantly wet, and if the Cholera is produced by currents of electricity, I am of opinion that the air passing through this medium would be deprived by the metal of the excess of electricity and thereby rendered innoxious: it might be worth a trial. When the tulips are out of flower the whole of the shading should be removed that the plants may receive the full benefit of the weather. In England when the stems are decayed we take up the bulbs, and I should think the same plan would be desirable in India, but when the bulbs are taken up they should be kept cool and not too dry, until the period best suited for planting them again.

HYACINTHS will require to be planted at the same time as the tulips, and the bed should be made much the same as for that flower, but the soil should be more sandy, and they require to be covered 4 inches deep, also to give them a greater distance from each other—six roots across the bed will be sufficient and about 8 inches from row to row in the length of the bed; it is a plant which requires considerable moisture during its growth, even more than the tulips. In a climate like India it will be desirable to shade them when in blossom to preserve the flowers, (which I should recommend to be done with all Florists' flowers,) although it may not be necessary to have so large a stage for them as for tulips. They should be taken up when the foliage is decayed and treated like the tulips.

RANUNCULUSES and ANEMONES should have the beds prepared in the same manner as for the tulips, and be planted at the same season; the soil should not be so sandy, but much richer; they should also be in a damp cool situation, as they require to be kept moist during their growth, otherwise they produce flowers sparingly, and of a small size. The ranunculuses should be covered about 1 inch and the anemones 2

Fig 1

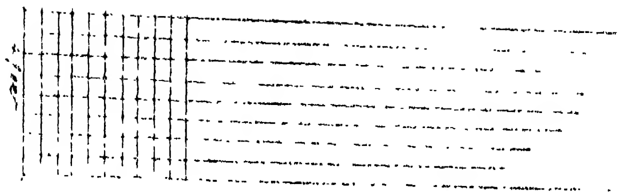
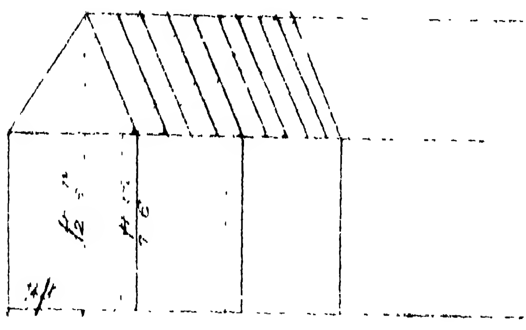


Fig 2



inches deep, they can also be planted closer than the tulips; the shading can be adopted when in bloom if thought desirable. When the foliage is brown the roots should be taken up and dried gradually; they must be kept in a dry situation until the time for replanting them.

ENGLISH and SPANISH IRIS require much the same soil and situation as tulips; they can be planted about 3 inches deep; it will not be necessary to take them up annually, neither do they want to be shaded.

CROCUSES will grow in any soil, but prefer a sandy mould; they should be planted deep, say 5 to 6 inches, as I have seen the finest flowers from deep planted roots; they do not want removal.

Clapham Rise, near London, 26th October, 1843.

Memorandum on the Manufacture, &c. of Black Tea, as practised in Assam. By JOHN OWEN, *Esq.*

To the Secretary of the Agricultural Society.

DEAR SIR,—With reference to the recommendation of Mr. Charles Terry in his report on Mr. Sconce's sample of Chittagong Tea, (published in the 9th No. of the Society's Journal,) to the effect that it would be desirable that parties interested in the cultivation of this plant at Chittagong should have some particular account of the process adopted in Assam by the Muttock Tea Company, I have the pleasure, with a view to assist in carrying out this recommendation, to submit the accompanying notes, in the hope that the hints contained therein may prove acceptable to the Society, and useful to tea cultivators in general.

I am, &c.

(signed.) JOHN OWEN.

Calcutta, 11th March, 1844.

I have for the last three seasons commenced picking my leaves from the 1st to the 8th and 9th of April, and I should be disposed to think that this might be done in most factories where a few days rain had fallen towards the end of March, followed up by a hot sun, for I have found in some plantations where the forest has been only partially cleared, and the shrubs consequently protected from the sun, that the young leaves come out very languidly, and are necessarily more thick and brittle, than in those gardens where the plants are more exposed. Night dews are very acceptable during the manufacturing season, and by most planters are much courted.

The best localities for *sown* plantations is undoubtedly on the slopes of hills, without reference to magnetic directions, or on irregular undulating lands. Spots of Indigenous Tea have been found on the plains, but the plants do not thrive so well.

In manufacturing I would recommend great care to be bestowed on the *building* of the Tea house, (a sketch of a proper one accompanies this.) *Light* is indispensably necessary for watching the growing and fading colours of the Teas, while being fired. *Room* for working is equally desirable, that your men may play freely, as quickness is so requisite in some parts of the process, that its absence is frequently the means of spoiling whole baskets full of the raw produce.

Though windows in the day time are so much wanted, yet, good shutters for keeping out the damp night air from the Teas must be had, or it may be necessary to give them another firing, which any thing but improves the quality.

In large factories, discipline, to command economy, is a grand thing to be attended to.

When each artizan has his own particular station in the Tea house, and is not allowed to move from it either to assist another, or leave the place altogether, it is astonishing

what a quantity of extra work may be accomplished, and in the first and second crops it often happens that the young leaves grow so fast that many of the manufacturers are required out to assist in the plantations by day, leaving work in the Tea house till midnight. This system I should be inclined to deprecate, however, where *it is not actually necessary*, and only to save the leaves from entire loss, as the smoke from the different lamps required to light up the place must, however imperceptible when new, throw a foreign flavor, deteriorating from the aroma of such a delicate leaf as the Tea.

I need hardly observe that *cleanliness* should be carefully attended to by the planter both in his rolling tables and the hands of the Artizans; for not having possibly any sensible effect on the leaves, still every delicately minded man would wish others to eat or drink as pure an article as himself, and it is difficult to impress on the mind of Natives the necessity of those frequent ablutions which are called for before commencing this operation.

In a certain part of the process the leaves are rolled on large bamboo mat baskets, about 3 feet in diameter, with a rim of 2 or 3 inches all round it. The strictest attention should be paid to the making of these baskets, so that in the motion of rolling the leaves on it, they would not be *cut* by the harsh edges of the bamboo which is very often the case, as may be observed by any person on saturating a few leaves of any kind of black tea. These baskets should also be well seasoned before use by keeping them 6 or 7 days under water, otherwise the planter is as liable to injure the *Aroma* as well as the *appearance* of his Tea.

The *charcoal* used should be of the finest description, and requires almost as much care in selection as the Tea leaves themselves. I would myself recommend close-grained woods destitute of gum, and this should be burned under ground, in the Chinese manner; the moment a piece of charcoal is

detected *smoking*, it should be removed, otherwise the Tea over it will be spoiled.

The process of *rolling* is perhaps the most difficult to learn, and it requires daily practice of some months to acquire a proper habit of it. It is effected by taking as many loose leaves from the tray or basket as can conveniently be compressed between both hands; then gradually roll these backwards and forwards until they form like a ball; they must be kept united, or they do not uniformly partake of the roll or twist which so prominently distinguishes the *better* Teas; although it is difficult at first to keep them united, a little perseverance with a determination to accomplish the task, will soon enable the tyro to overcome all difficulties. It should however be understood that the *twist* is what is required, the necessary peculiar volution of the hand therefore will be readily understood.

I would, from experience, here suggest to the planter, that in the periods of gathering, his pickers be divided, according to the number he may have and the size of his plantation. For instance, instead of picking the leaves of all sizes promiscuously and throwing them into one basket, post off your men; if there are 50 engaged for the work, supposing you may desire four sorts of Tea, order twelve (marked No. 1,) to bring in Pekoe leaves, twelve more (marked No. 2,) for Souchong, twelve more (No. 3,) for Congou, and the remainder (No. 4,) for Bohea, if this latter be wanted, though this class of leaf by the bye in Assam is not so easy to manufacture into any thing saleable on account of the enormous size of the leaf.

After a picking, to give vigour to the plant for its next supply of leaves, it becomes necessary to look carefully to its roots. My own practice has been strictly to watch the trees and assist their subsequent produce by not only thorough weeding, but by a gentle hoeing near the roots, and earth thrown up afterwards round the root to the height of

some 7 or 8 inches. To secure a good crop as well as good produce, I would recommend that the plants (if an artificial plantation) be not sown too near to one another. Where Tea is indigenously found, ground is generally, I think, not much in request. One of the Government plantations in Assam, *Chubwa,* is a proof of this assertion, the young suckers and plants not having been removed from around the parent stems, the soil had become exhausted, and but few leaves are obtainable from these. *Pruning* too is absolutely necessary to check the plant, naturally wild, from shooting up beyond picking height, but the most proper time for this I am myself not competent to judge of, although very desirable that it should be ascertained. It is more than probable too that the operation known in Horticulture as *stopping,* would be a preferable method of obtaining this object.

In sowing, where you have an abundant supply of seed, I would recommend from two to three to be put 3 or 4 inches deep in each hole, at distances of six feet from one another, and at each of these places any particular mark, such as an arrow or piece of stick, should be placed, as in weeding the young plants might stand a chance of being rooted up. This way of planting I have found to be more profitable and to yield ultimately finer trees than those educated in a nursery close together, and afterwards transplanted, for the spiral root, when taken up even carefully, is slightly damaged, and stunts, if not altogether kills the plant.

When the shrubs arrive to the height of three feet they should be topped down to force the stem in throwing out branches laterally and thereby form a bush. Should more than one of the three come up, I would recommend the weaker plants being thrown away. A few days prior to the young leaves appearing on the trees, that is about March, it is advisable to pluck and throw away *all* the old leaves that may be on, taking care that they *are not torn off,* because if this be done the young leaf between the stem and the old leaf may be carried

away, and thus harm done by loss of produce. All leaves taken from the plants should be *plucked off* with the thumb and fore finger, leaving the stalk with a small portion of the leaf attached to it.

After the foregoing data, in which perhaps observations may appear, likely to prove of benefit to the planter, I will proceed to notice the different instruments used in the Tea house.

Instruments.

Pans,—(*Koras,*) diameter about 2 feet, and depth 10 inches, with round rims.

Tables for rolling.—The best are 4 feet in breadth, with proportionate length to the size of the plantation, and with reference to height as conveniently for rolling as the size of the people in the province will admit.

Dollahs,—or rounded flat mats for rolling the Tea on also, (or those before spoken of) as being 3 feet in diameter with a 2 or 3 inch rim all round.

Challonees, for drying the leaves out in the sun. They are of 2 shapes, one the size of the Dollah, the other nearly double. In kind it is more of a sieve than the Dollah, which is mat work, or bamboos laid close together. In the *Challonee* each bamboo should be half an inch in breadth, leaving another half inch open (sieve like) and so on alternately.

The Hadjee, also of bamboo *mat* work, in shape resembling a common *Morah,* without a top, and all the inside of it papered. A convenient sized one should be about 3½ feet high, 2 feet at the extremities, tapering inwards towards the centre, at which place it is about 1½ feet, so as to receive another small sieve.

A small sieve, to fit in the centre of the Hadjee, which holds the Tea whilst drying over the charcoal fire.

Flue, a small bamboo one which stands erect in the centre of the *small sieve* in the *Hadjee,* round which the Tea is

packed. *Poker, Tongs, and Shovel* for stirring up the fire in the furnaces.

Baskets, of depth for bringing in the leaves, with a piece of rattan attached for the purpose of slinging it round the neck, that the pickers may command both hands.

Choolas, or a row of mud recesses for the reception of charcoal, over which the *Hadjees* are placed to dry the Tea.

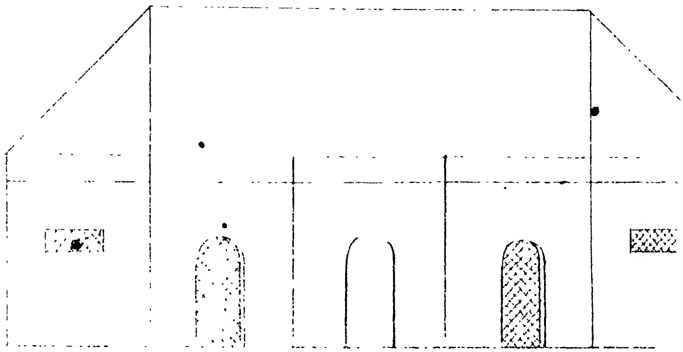
Manufacture.

In picking, the three or four end leaves may be plucked off *with the stalk altogether,* the remaining under ones nipped off at the end *leaving the stalk* on the tree, the former are usually manufactured into Pekoe and Souchong, and the latter into Congou and Bohea. On their being brought in by the pickers to the Tea house (if a sunny day) they should be lightly scattered over the *challonees,* and these latter be placed out in the sun on a *Machan,* or bamboo frame work, which whether for real use or merely *Deknee-ka-wastee,* I don't know, but it is generally built diagonally.

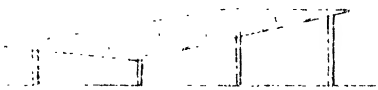
When the stalks of the younger leaves appear faded, are perfectly supple, and will bend round, it is time to take them back into the Tea house, where they are placed on gratings built on purpose, until they get perfectly cool. They are then brought down, placed on the table and beaten, or rather tossed up between the arms and hands until the serrated *edges* of the leaves have assumed a reddish hue. Put them again in the sun on the *Machan* for a short time, and when wearing an increased withered appearance repeat the former operation, that of cooling and beating. They are now fit for the pan. Prepare your furnaces, (*with wood* not charcoal) wash your Pans well, throw in your leaves, when moderately heated, turning them continually over with your hands or two pieces of wood, taking care to give all as nearly as possible an uniform gradual heat; when no longer bearable

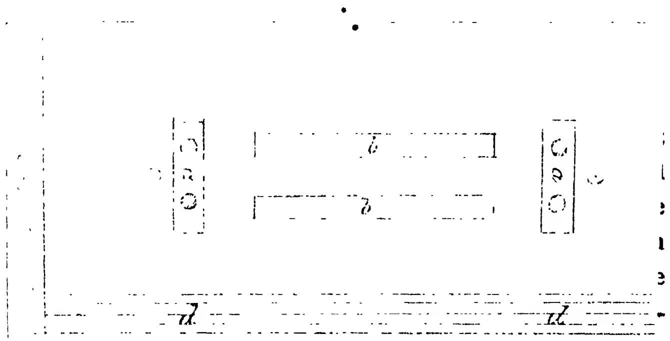
to the hand, throw them suddenly out into a *Dollah*, which must be ready to receive them, in the hands of one of your artizans, (stationed there for the purpose;) place this on the table, and while hot allow your rollers to take each a handful, and endeavour to give by this operation to the leaf as perceptibly permanent a twist as you possibly can. (Ten minutes rolling for young leaves will suffice. The tougher ones proportionately require more.) Now scatter as gently as possible, these lumps out on *Dollahs*, until the leaves separate without injury to the twist; let them cool, and when perfectly so, introduce them again to the pan to go through a second firing. Roll again on the table, scatter *more* gently out on the *Dollahs*, and lay them by on the grating till cool. Then light your *choolahs* with charcoal, taking care that *no* smoke arises from it, and lay thinly on the *small sieves* the leaves which now begin to wear the appearance of Tea inside and at the centre of the Hadjee; when found to be dry and crisp take them off the fire and lay them by on *Dollahs* and on the gratings. This is considered all of the first day's work. In the morning divide your men, half to repeat the foregoing process as directed, and the other half to go on finishing the former day's as I will now direct.

The fried leaves, it will be recollected, were laid by in *Dollahs* on the grating in the Tea house. Turn the hands out at daylight, and giving a Dollahful to a couple of men, let them pick out and separate all those of corresponding sizes, when this is done light your *choolahs* again. Place your *Hadjees*, with the *little sieves* over them. Place also the *Flue* upright on the centre of the *little sieve*, pack the partially manufactured leaves of yesterday all round it up to the top of the Hadjee, and allow it to remain over the fire (without the instrument receiving even a single shake) until the leaves gather a sufficient crispness and uniformity of color, by the heat; over slow fires they are sometimes allowed to remain all night, but a practised eye, and attentive



Elevation.
Scale 10 Feet 1 Inch





Ground Plan.

References.

a.a	Tea pans.
b.b	Rolling tables.
c.c	Choolas.
d.d.	Dollah Racks.

watching, can alone determine the precise time of its finish. One circumstance I must not omit, it being one of serious loss if neglected,—the necessity of not even touching the *Hadjee* while with Tea in it over the fire, lest even one leaf should fall through the sieve and be burned, causing smoke, which would of course spoil the whole. When this is cool, pack into your boxes, taking care to press the tea down with both feet and hands. Tea in a box when opened ought to be so well packed as to entirely resist the arm when introduced into it.

An account of the process of green tea manufacture shall hereafter be forwarded.

A few brief Notes on the Cultivation of Sugar Cane in Bengal. By S. H. Robinson, *Esq.*

Having been long impressed with the idea that the Sugar Cane of Bengal owes its inferiority to that of the West Indies at least as much to the defective cultivation afforded to it as to the less favorable condition of soil and climate it experiences, I made last year some experiments on a small scale, with the view of testing the truth of this opinion. The most remarkable difference in the cultivation here and in the West Indies appears to be in the time occupied in the growth of the canes :—from 12 to 15 months being the general period occupied by that of the latter, whereas the common Bengal practice of planting after the middle of April and cutting in the following January or February allows at the utmost 9 to 10 months for the maturing of the plant :—the conclusion naturally arising from which is, that the cane during this short and quick vegetation has not the time to imbibe the strength, size, and richness of its transatlantic competitor.

I accordingly planted in the same field cuttings of the Native yellow cane (the Poree kind,) on three several dates,

viz. on the 6th February, the 5th May and the 20th May, carefully measuring the ground occupied by each. No extraordinary care was bestowed on the cultivation, the ground having been prepared with the common Native plough, and manured with cow dung and some earth from the bottom of a dry tank, as customary in this district, (Burdwan.) The only extra attention required by and afforded to the February plants being the additional weedings and waterings required during the dry months.

The results will perhaps be more clearly explained by the following form, where the circumstances of the three experiments are noted down in juxtaposition.

No. of Expts.	Date when planted.	Sq. feet of ground occupied.	Rough measurement of ground in Cottahs.	Number of weedings.	Number of waterings.	Date of first tying.	Date when cut.	Weight of cleaned cane in B. Mds.		Average produce in B. Md's. per Beegah.
No. 1	Feby. 6th	1650	$2\frac{1}{4}$	3	7	July, 6th	Jan. 25	26	13	234
No. 2	May, 5th	5500	$7\frac{5}{8}$	2	3	Sept. 15th	Ditto,	50	37	$133\frac{1}{3}$
No. 3	May. 20	2970	$4\frac{1}{8}$	2	3	Ditto,	Ditto,	26	9	$123\frac{2}{5}$

From several trials made by weighing the canes and measuring the fields from which they were produced by Native cultivators in this neighbourhood, I have ascertained that a good average produce is about 150 B.Mds of cleaned cane per Beegah: the above experiments, Nos. 2 and 3, therefore appear to have been rather unfavorable in their results; but as the cane of No. 1 experiment was planted on the same field, and tended under exactly similar circumstances, save and except as to its priority in time and the extra weeding and watering, it is fair to consider that the produce of the latter also may be rather below than above what it ought to have been, and in like proportion.

Taking therefore the three experiments as they stand, and valuing the canes at Co's. Rs. 16 per 100 B. Mds, (a fair average rate) we have, on a rough calculation, Co's. Rs. 35 : 8 per B^{h}. as the value of produce by experiment No. 1 ;—Co's. Rs. 21 : 8 for that of experiment No. 2 ;—and Co's. Rs. 20 for experiment No. 3 ;—or taking the average of the two last, about Co's. Rs. 14/12 per Beegah in favor of the February planting.

It should be mentioned that some seasonable showers in February and March last year were in favor of the early plants; and perhaps, as such could not generally be reckoned on, six extra waterings instead of four, the number required as above, should be accounted as requisite on the average of seasons; and allowing each watering to cost at the high rate of one rupee even, and extra weeding 12 annas per Beegah, we should still have 8 Rs. per Beegah clear gain by the method of planting in February.

In the foregoing remarks the superior *quality* of the earlier planted Cane has not been noticed: unfortunately the quantity was too small to allow an examination of the juice produced from each crop; but from the appearance of the plants the presumption is greatly in favor of a far finer produce being obtainable from the February cultivation, the canes of the latter being larger both in length and diameter, and the difference of their aspect from the May plants standing next to them, was very remarkable throughout the whole time of their growth, and shewing when ripe an average height of at least 18 inches above the May crops.

The experiments altogether may perhaps be considered on too small a scale to warrant any accurate inferences being drawn therefrom: but though perhaps requiring further and larger experiment to confirm the results satisfactorily, the facts attained are sufficient to convince me of the great advantage to be gained by the earlier planting where the means of irrigation are within reach, and I am therefore induced to offer my notes, such as they are, to the Society.

I may also notice that a small plot of Otaheite Canes planted at the same time, with exactly similar treatment, and in the same field with the Native cane of experiment No. 1, suffered so much from the white ants that about one-third only of them survived, and therefore no satisfactory deduction as to their produce was, or could be, attempted. Mr. Wray in one of his papers in the Society's Journal mentions a similar remarkable partiality of the white ants to Otaheite cane in his plantation in the Goruckpore District, but for which he does not attempt to account.

I am this year making trial of the China Canes, and as I hope for better success with them, I shall perhaps be able to offer some further remarks on this subject by and bye.

On the best mode of propagating plants in India. By Mr. Robert Ross, *Head Gardener, H. C. Botanic Garden, Calcutta.*

To James Hume, *Esq. Honorary Secretary of the Horticultural Society of India.*

1. Sir,—Having been requested by Mr. Blechynden to draw up some practical memoranda on Horticulture, suggested by my experience as a gardener in a tropical country, I have the pleasure of submitting to you the following remarks on cuttings :—

2. At present nothing appears to me so necessary to be generally known as the propagation of the many choice plants annually given away from this liberally supported establishment, more particularly as the present Superintendent, Dr. Griffith, intends giving none away, but really choice plants, whether indigenous or exotic; such an arrangement, I have no doubt will give satisfaction to all who may apply for plants.

3. Many parties have an annual supply. This I believe would not be the case generally, if the applicants knew how easily they might increase many plants: I chiefly refer to

families who keep one, or more *mallees*. It is well known that native gardeners have a very rough idea of gardening,' but if their employers knew how to point out what ought to be done in the flower garden, and in the propagation of plants, they might improve, and ultimately become a more useful class in India.

4. I beg to point out in the first place, the sort of bed necessary for the propagation of plants from cuttings in this climate, and then the mode of treatment to be attended to. An open space of ground is to be selected, free from shade, (or what is more injurious to cuttings, the drip of trees in the rainy season,) where a bed of brick and mortar is to be made; the foundation need not be more than three or four inches below the surface; the walls need only be one brick thick, and about two feet high, three feet wide in the clear, and of any length, according to circumstances, or the number of plants to be propagated. One thousand plants or more, under a careful hand, can be produced from a bed, three feet wide in the clear and six feet long, in one year. When the bed is ready for filling with mould, &c., about eight inches of broken flower pots, bricks, or any thing else that will answer for good drainage, is to be placed at the bottom, on the top of this four or five inches of common mould, the bed is then to be filled up with sand, the finer the better, as coarse sand will not answer so well; a bed thus made, is ready for all the purposes intended. The next things required, are bell glasses and mats to cover and shade the cuttings in the bed after planting. The object of thus covering the cuttings with glass is to prevent evaporation; this is done by pressing the glasses firmly down on the sand bed over as many cuttings as the glasses will hold. If bell glasses cannot be had, common hanging lamps will answer the same purpose, and indeed, are much better for large cuttings 12 or 18 inches in length.

5. The distance at which the cuttings should be placed under the glasses must depend on the size of the foliage;

for small cuttings with small leaves, two inches will be found enough, and so in proportion. Small cuttings, those for instance 4 or 6 inches long, will require to be planted about 1½ inch deep and firmly pressed in the sand: when all are planted, they are to be watered, the glass placed over them, and shaded from the sun, from 8 in the morning to 5 o'clock in the evening, sooner or later according to the season of the year; the glasses need not be taken off more than once or twice weekly to give a little water and keep the cuttings clear of any decayed leaves, &c. &c.

6. What I mean by cuttings is not simply cutting a shoot or a branch into so many pieces and sticking them in the ground; this will answer for some soft-wooded sorts, but not for hard-wooded plants. For preparing cuttings of the more difficult hard-wooded plants, the young shoots, when long enough, say 6 or 8 inches more or less, are to be cut off with a portion of the former season's growth.

I here refer to plants requiring a previous preparation, say one or two months before suitable cuttings can be had; many plants throw out long straggling shoots, such for instance as the following:—

Buginvillea spectabilis,
Bignonia equinoctialis,
Banisteria periplocifolia,

and others of similar habits. One or more of such shoots should be stopped, by cutting away the top of the shoot; this stopping will cause each shoot so treated to throw out laterals; when these lateral shoots are long enough, as referred to above, they should be taken off with a portion of the shoot that was previously stopped in its growth, the leaves cut away as far up as the cuttings are to be placed in the ground, all the rest are to remain; it is immaterial what length cuttings so prepared may be, provided glasses can be had high enough to receive them. Ordinary bell glasses will not receive a cutting more than 6 or 8 inches in length; but if large hanging lamps are used, then the cuttings may

be made 12 or 18 inches in length. Relative to the plants more easily propagated, such as

Poinsettia pulcherrima,
Abutilon striatum,
Orthostemma roseum, &c.

it is immaterial of what moderate length the cuttings may be, or what the number of eyes. I have it is true named above the length cuttings should be made, but I have done so simply to accommodate the cuttings to ordinary sized bell glasses. None of the bell glasses we have in this garden, and I believe we have some of the largest to be found either here or in England, will receive a cutting more than 6 or 8 inches in length, but if large lamps are to be used, then the cuttings can be lengthened accordingly, and will throw out roots as freely as smaller cuttings. We shall suppose that a person has a choice individual plant (say Poinsettia pulcherrima) of which he wishes to make as many as he can, and has only one shoot, and consequently but one bloom, (this plant throws out lateral flowers along the sides of the shoots, but these are never so fine as those produced on the top of each shoot.) After the flowering season, cut the shoot down to 4 or 5 eyes, from each of the eyes thus left on the old plant a shoot is expected to spring, and consequently a bloom, so where you have but one on the plant this season, next season you will have four or five, and by an annual pruning in this way until the plant has formed a proper head, you will have an increase of bloom every year; if the plant is left without pruning it will form a straggling, unsightly head. I have above supposed one of these plants to have but one shoot; to make the most of this shoot, cut it in lengths of 2 eyes each, one eye is meant to form the root end of the plant, and the other the head; from such a plant only one good bloom will be produced the first season; if three or four are to be expected from a plant the first season, then the cuttings must be cut in lengths of 5 or 6 eyes; from such a cutting three or four blooms may be expected the first year. We

allow all the leaves to remain on the cutting only on the root end; we trim off as far up as the cuttings are meant to be placed in the ground, deciduous plants excepted. The best season to put down cuttings of such, is after they have shed their leaves, but they may also be propagated at any season, in this climate. It may be necessary here to say, if what is stated in this paper is not strictly attended to, parties making a trial will not succeed; I mean relative to the glasses being firmly pressed down over the cuttings to prevent evaporation and shading from the sun; the mats will also require to be fastened over the glasses in windy weather; if this precaution is not used, the cultivator may lose all his plants in a short time. Shortly after I came to this garden, I succeeded in raising a glass-full of cuttings of Olea fragrans, but through the negligence of the *mallee* in charge in allowing the mats to be blown off in a sudden gust of wind, I lost the whole of them in about half an hour; they were literally roasted, not a spark of life was left in one of them, and this after six months' care and attention was very trying; such will be the case if care is not taken.

7. The proper season to multiply plants from cuttings in this climate is during the rains, when the ground is like a moist hot-bed; it is true cuttings will root here at all seasons with proper care and attention, but that care cannot be bestowed by all, therefore I recommend the rains as the best season, for then little care is wanted beyond shading the cuttings from the heavy rains, and the occasionally burning sun; indeed I may add, there are some of the hard-wooded plants it would be useless to attempt to propagate from cuttings, except in the rainy and cold season. The number of this class is, however, but few, compared with what may be propagated at all seasons.

8. The length of time the cuttings will require to be in the bed before they will have roots enough to admit of their being potted off, depends on the sorts; the free-growing sorts will require about one month, and hard-wood-

ed, about six months; generally speaking, if they are not found to root or shew signs of rooting within this time, there is little chance of such being raised from cuttings. The Olea fragrans takes about six months, but if this plant is raised from layers, it will take 18 months or 2 years before a well-rooted plant is produced. I refer to the Indian mode of layering such plants in small pots, but if the layers were placed in the ground, instead of pots, they would root much sooner; but when one can raise 40 or 50 plants of this species under an ordinary hand glass in 5 or 6 months, it is useless to trouble oneself with layers, gootys, or grafts.

9. The reason why I recommend sand beds for cuttings, as referred to above, is this, the cuttings cannot at any time be over-watered, the sand will hold no more water than is sufficient to keep the cuttings moderately moist; if they should at any time get an over-supply of water, it escapes as fast as it falls through the drainage below; a moist friable soil is essentially necessary to excite roots; common mould by constant watering becomes hard, the surface alone is watered, consequently that part of the plant that wants most moisture gets none, or at least very little, unless there is such an abundant supply of water poured on, as to make the surface of the consistence of fresh mortar, and this under a tropical sun where the ground dries so soon and cracks so freely, would not answer.

10. When the cuttings have roots enough, they are to be potted off early in the morning, or late in the evening; after potting, water freely to settle the mould about the roots, shade them for a few days until they recover the shift, afterwards expose them gradually to the sun. Do not plant them deeper in the pots than they were in the bed, and be careful not to injure any of the roots by pressing the mould round them in the act of potting; indeed for delicate roots, it will be found best not to press the mould in the pots, but let it settle of itself by means of a good watering.

It is a common custom with *malees*, in potting plants, (unless they are watched,) to place the roots on the bottom of the pots, and press the mould around the roots as firm as they can ; by this means the roots are covered too deep, and with an ordinary watering in the dry season they never get the least moisture, death or sickliness is the consequence.

11. The compost the major part of flowering shrubs, &c. will be found to thrive in, consists of one-fourth well rotted cow-manure, one-fourth vegetable deposit, one-fourth river sand, and one-fourth common mould well incorporated ; if only fresh cow-manure is procurable, it is to be placed in any out-of-the-way corner, and covered over with about one foot of common mould, and there allowed to remain for about sixteen months, when it will generally be found fit for use. If vegetable deposit is not at hand, collect all the leaves available, throw them into a shallow tank or hole ; good vegetable mould will be found in it in about twelve or eighteen months ; but if the leaves are thrown into a deep tank full of water, those only between what is usually called wind and water, will rot in about twelve or eighteen months. Provided they are kept moderately moist, leaves will generally be found to have enough within themselves to excite fermentation. I believe I may say Teak leaves excepted ; at present I know of none else. If leaves are thrown into a tank full of water, they will turn black and not rot so soon.

12. The free growing sorts root so soon after planting, it is scarcely necessary to say any thing about them ; they form a head rapidly, and this they would not do if they were not sufficiently rooted to pot off, so the cultivator is not long kept in suspense. In the rainy season, many of the species will be fit to pot off in three weeks after the cuttings have been planted under the glasses ; if in about one month after the cuttings of the more difficult sorts have been planted under the glasses, the leaves keep green and fresh (many species shed their leaves, but one is not to suppose because this is the

case the cuttings are likely to die, but on the contrary,) the eyes begin to swell, and the bark appears plump, not shrivelled, the cuttings are likely to root: again, if there is no visible change in the cuttings to lead one to suppose roots are forming, or have formed, take one of the cuttings carefully up, and if a ring of granulated matter is observable, cuttings in such a state will be sure to throw out roots very soon, but many plants which are difficult to root, as orange trees, oleas, (the olive,) camellias, heaths, &c. will be found in the first instance, and for some considerable time after propagation, to throw out roots only from the granulated ring, or ring of herbaceous matter, above-mentioned; and to facilitate the formation of this ring by properly preparing the cuttings of the most common plants, is, or must be, a great advantage. I am well aware it is a common practice with many gardeners at home to cut off the whole, or part, of the leaves of cuttings, which I have found in India always attended with bad effects. With evergreens, I believe the leaves of such plants or cuttings supply nourishment to the cuttings till they can sustain themselves; indeed I know from experience, this is the case. As I have observed above, it is necessary to trim off all the leaves as far up as the cutting is meant to be placed in the ground, but let all the others remain entire, if the plant is not deciduous.

The preparation of a cutting of any plant depends on, or is guided by, this principle—that the power of protruding buds or roots resides chiefly, and will be found in most cases entirely, at what are called joints, or at those parts where leaves or buds already exist; hence it is, that cuttings ought always to be cut across with the smoothest section possible, at an eye or joint, and as buds are in a more advanced state in wood somewhat ripened or fully formed, than in wood in a state of formation, this section should be made in the wood of the growth of the preceding season, (see Sketches,) or, as it were, in the point between the two growths. It is true, that there are many sorts of cuttings which throw

out roots not only from the ring of herbaceous matter referred to above, but also from the sides of every part of the stem inserted in the soil, whether old and large, or young and small, such as willows, currants, vines: gooseberries, &c.

13. The following is a list of some of the plants considered by many hard to multiply from cuttings :—

Magnolia fuscata,
——— pumila,
——— pterocarpa,
Lagerströmia elegans,
——— grandiflora, and all the other sorts,
Oranges and Limes, all the sorts,
Olea fragrans,
Chiococca racemosa,
Ixora acuminata,
—— lanceolaria,
—— blanda, Ker, (I. alba, R.)
—— Bandhuca,
—— coccinea, and all the rest of the species,
Bignonia equinoctialis,
——— suaveolens,
——— amæna, &c. &c.
Astrapæa Wallichii,
Dombeya acutangula,
——— palmata, &c. &c.

It is needless to enlarge this list, enough has been named to give the reader an idea of the sorts requiring similar treatment under glass.

14. In the rainy season a flower garden may be successfully planted with handsome flowering shrubs, by planting branches in the beds or borders where the plants are meant to stand, instead of rooted plants; they will soon become large and flower freely, and parties may increase single plants they may possess to any extent, without much trouble, care, or expense. Subjoined is a list of plants that will answer for this mode of propagation; such need not

be covered with glass, or shaded, if they are put down in the rains :—

Petalidium bignoniaceum,
Strobilanthes scabra,
——— callosa,
——— elegans,
Goldfussia anisophylla,
——— isophylla,
Barleria cærulea,
——— prionites,
——— cristata,
——— dichotoma,
Asystasia coromandeliana,
Phlogacanthus thyrsiflorus,
——— curviflorus,
Poinsettia pulcherrima.
Salvia splendens,
——— coccinea,
Russelia juncea,
——— floribunda,
Hamelia patens,
——— ventricosa,
——— chrysantha,
Passiflora kermesina,
——— quadrangularis,
——— lunata,
——— Mayana,
——— laurifolia, and all the others known to me except racemosa,
Malvaviscus arboreus,
Abutilon striatum. To preserve this plant in health, it will be necessary to put fresh cuttings down every year, and throw away the old, as they become unsightly, if not pruned judiciously,
Lawsonia inermis,

Many of the above produce seed annually, but large cuttings will flower much sooner than seedlings.

I am, Sir,
Your most obedient servant,
Robert Ross,
Head Gardener.

Honorable Company's Botanic Garden, April, 1844.

Reference to the Sketches.

No. 1. Represents a cutting, or the whole of a lateral shoot of Buginvillea spectabilis, taken off with a portion of the shoot from which it sprung.

No. 2. Represents a cutting of Olea fragrans, of this season's growth, taken off with a portion of the preceding season's growth.

N. 3. Represents a cutting of Poinsettia pulcherrima, but as this plant is so easily propagated, and will throw out roots from every eye or joint in every shoot of ripened wood, it is not necessary to say more than simply cut the shoot, or shoots, into lengths of 2, 4, 6, 8, or 10 eyes or joints each, according to the number meant to be propagated, and plant them in the ground where they are meant to stand, if such should be the wish of the propagator if not; plant them singly in pots, and when rooted they can be turned out and planted with the ball of earth entire without disturbing the roots, but if more than one cutting is put in a pot until they have rooted, and then shifted into separate pots, they will suffer by such treatment, and there will, without great care, be some deaths.

No. 4. Represents a cutting, (the top of a shoot,) of Hibiscus Rosa chinensis. It is immaterial how cuttings of this, or plants of similar habits are made, every branch if made into cuttings will throw out roots.